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Monthly Bulletin of the International Railway Congress Association

(English Edition)

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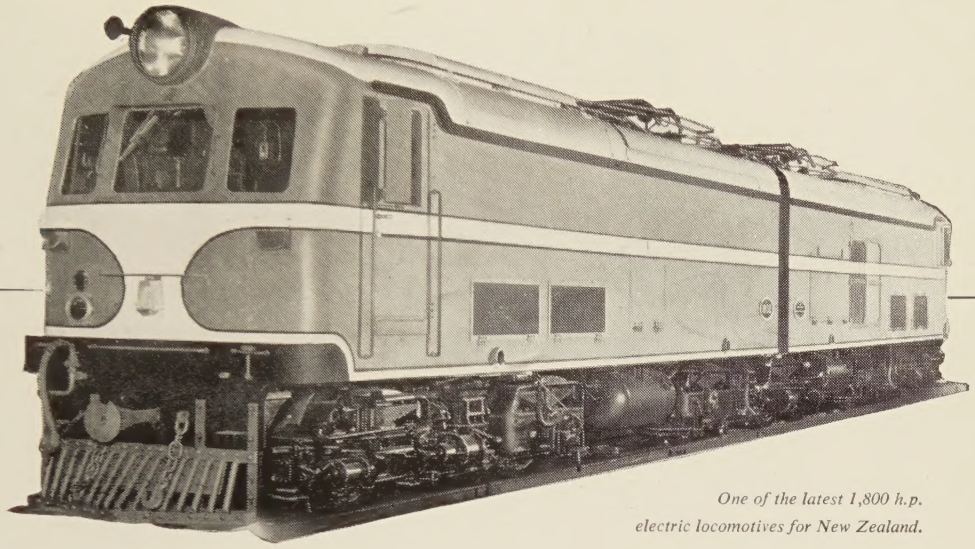

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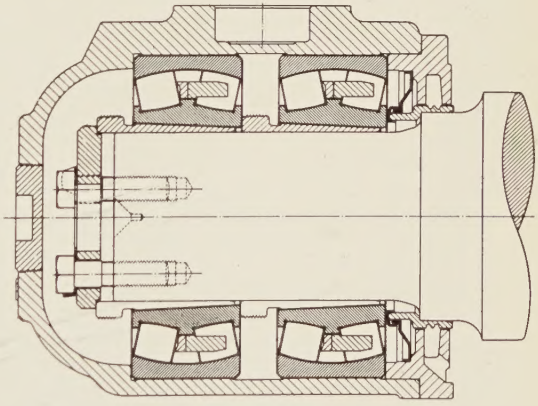

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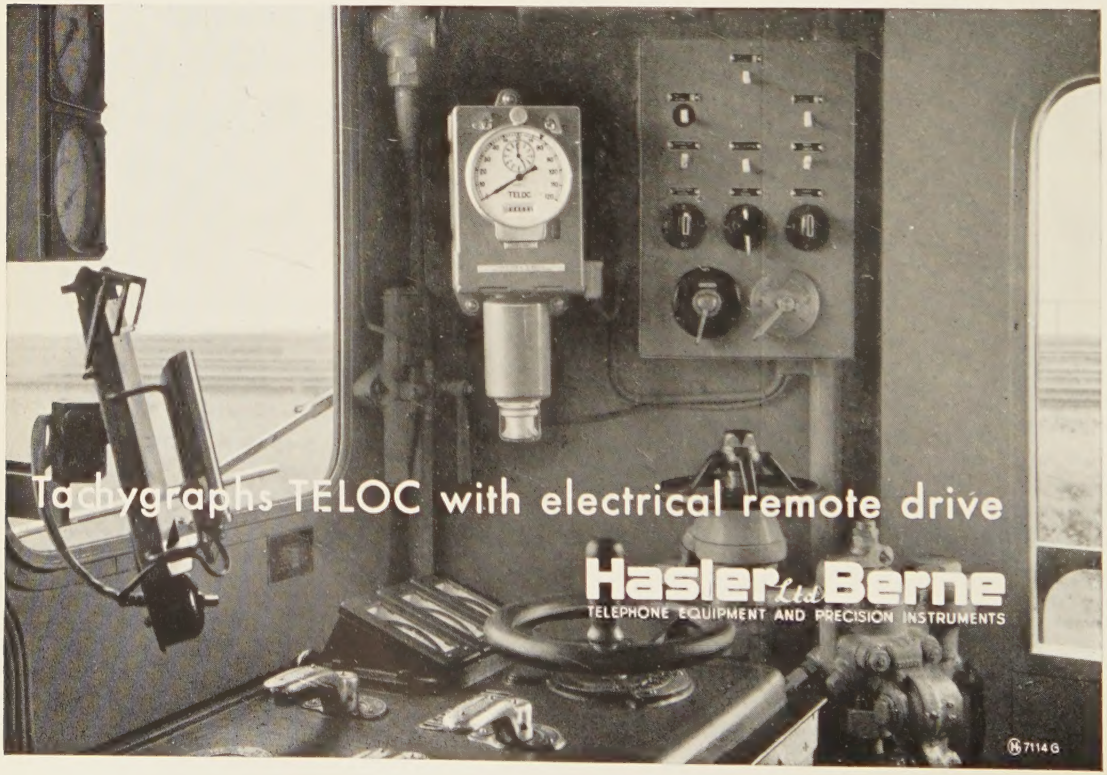
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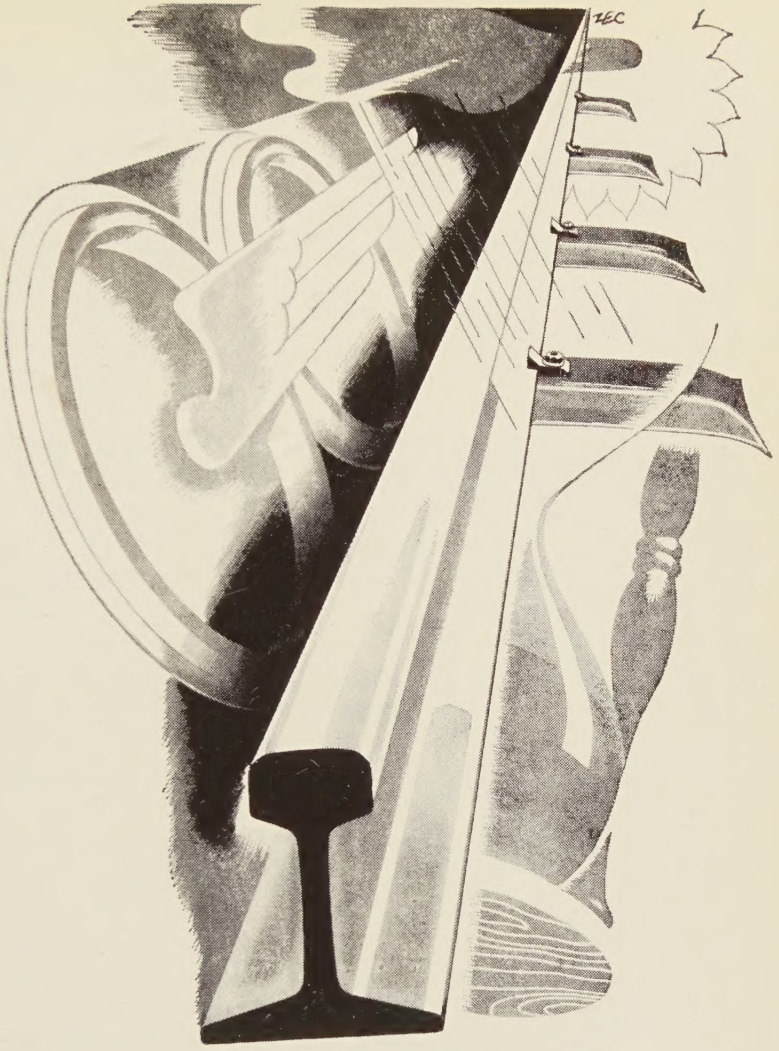

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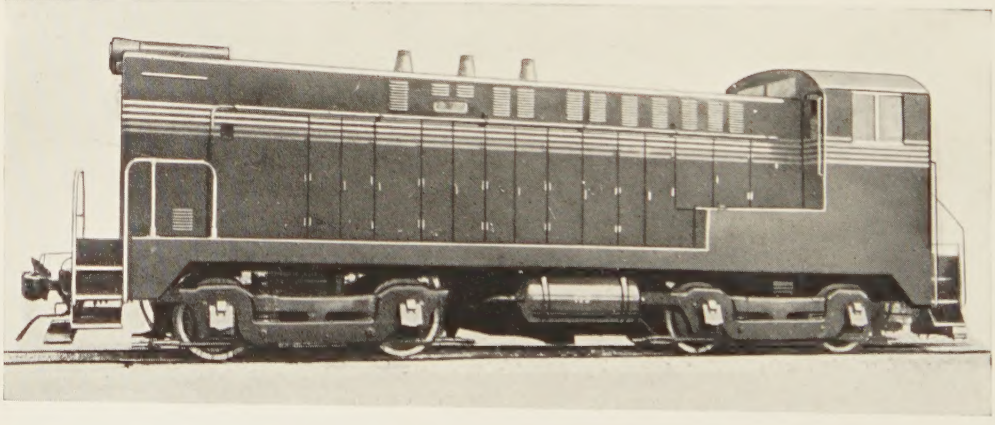

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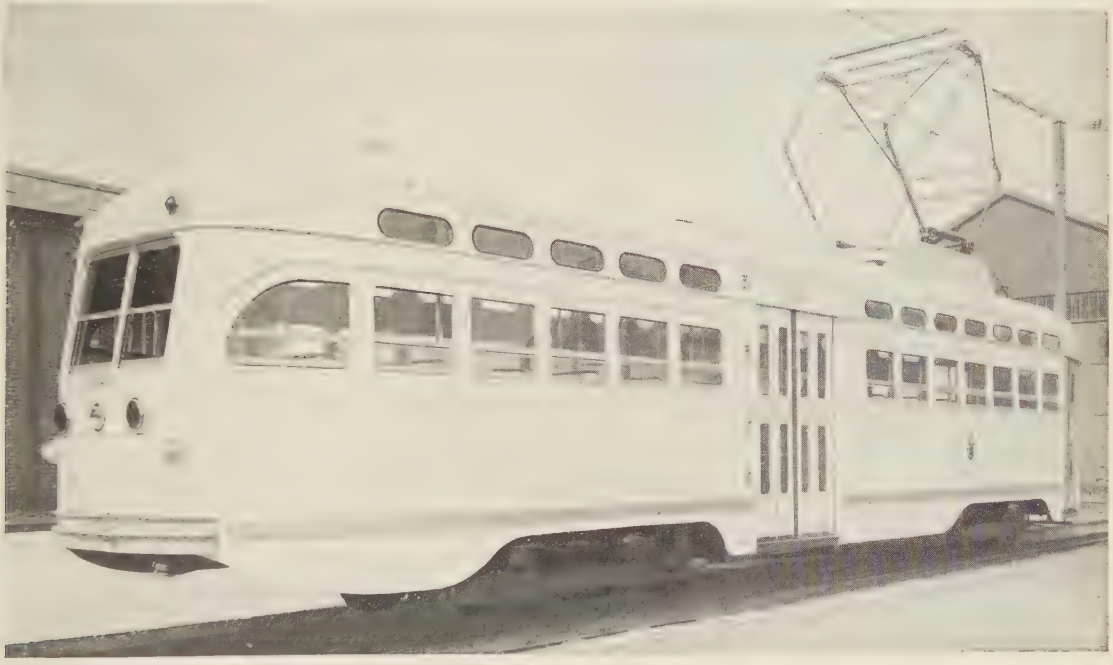

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MONTHLY BULLETIN

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(ENGLISH EDITION)

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Advertisements : All communications should be addressed to the Association, **19, rue du Beau-Site, Brussels.**

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An edition in French is also published.

Bulletin of the International Railway Congress Association

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1952 **625 .162 & 656 .254**

Bull. of the Int. Ry. Congr. Ass., No. 5, May, p. 343.

DONIZEAU (A.). — **A) What are the new safety measures taken for level crossing of railway tracks by the road in respect of the density, high tonnage and speed of the road traffic? B) Cases of level crossing of railway tracks by a road with a railway (urban or suburban) running alongside.** (Question I, Enlarged Meeting of the Permanent Commission, Stockholm, 1952). Report *(Austria, Belgium and Colony, Bulgaria, Czechoslovakia, Denmark, Finland, France and Overseas Territories, Western Germany, Greece, Hungary, Italy, Luxemburg, Netherlands, Norway, Poland, Portugal and Colonies, Rumania, Spain, Sweden, Switzerland, Syria, Turkey and Yugoslavia).* (22 000 words, tables & fig.)

1952 **656 .225 & 656 .261**

Bull. of the Int. Ry. Congr. Ass., No. 5, May, p. 397.

SAUVAGEAT (F.). — **What are the quickest and most economical means to carry out door to door service for railway transports? What are the best conditions of use of containers for small miscellaneous traffic (dimensions of the containers, conditions of ownership, tariffs)? What are the packing types to be recommended?** (Question II, Enlarged Meeting of the Permanent Commission, Stockholm, 1952). Report *(Austria, Belgium and Colony, Bulgaria, Czechoslovakia, Denmark, France and Colonies, Finland, Western Germany, Greece, Hungary, Italy, Luxemburg, Netherlands and Colonies, Norway, Poland, Portugal and Colonies, Rumania, Spain, Sweden, Switzerland, Turkey and Yugoslavia).* (24 000 words, tables & fig.)

1952 **385. (06 .111**

Bull. of the Int. Ry. Congr. Ass., No. 5, May, p. 487.

OFFICIAL INFORMATION ISSUED BY THE PERMANENT COMMISSION OF THE INTERNATIONAL RAILWAY CONGRESS ASSOCIATION. — **Meeting of the Permanent Commission, held on the 1st March 1952.** (*Appendix :* List of Members of the Permanent Commission of the International Railway Congress Association). (2 000 words.)

Vol. XXIX. — No. 5. May 1952.

BULLETIN

OF THE

INTERNATIONAL RAILWAY CONGRESS

ASSOCIATION

(ENGLISH EDITION)

[625 .162 & 656 .254]

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

ENLARGED MEETING OF THE PERMANENT COMMISSION
(STOCKHOLM, 1952.)

QUESTION I.

A. — What are the new safety measures taken for level crossing of railway tracks by the road in respect of the density, high tonnage and speed of the road traffic?

In particular automatic signalling and closing of level crossings without keepers, worked by the trains themselves.

Technical and statistical investigation in order to ascertain the relative safety of :

1° level crossings with keepers, with the different devices to announce the arrival of the train to the keepers;

2° level crossings without keepers :

a) without any self-acting device announcing the arrival of trains;

b) with automatic signalling for the road-users;

c) with automatic signalling completed by half- or entire gates.

B — Cases of level crossing of railway tracks by a road with a railway (urban or suburban) running alongside.

REPORT

(Austria, Belgium and Colony, Bulgaria, Czechoslovakia, Denmark, Finland, France and Overseas Territories, Western Germany, Greece, Hungary, Italy, Luxemburg, Netherlands, Norway, Poland, Portugal and Colonies, Rumania, Sweden, Switzerland, Syria, Turkey and Yugoslavia),

by A. DONIZEAU,

Chef du Service de la Voie et des Bâtiments de la Région Ouest de la Société Nationale des Chemins de fer français

Seventy-eight Administrations were consulted and replies were received from thirty-eight. In twenty-three cases, the replies received covered nearly all the questions asked. In the other cases, many questions were left unanswered, chiefly on account of the fact that owing to the character of the railway concerned the problems in question did not arise.

The following Administrations replied (1):

Germany :

Deutsche Bundesbahn.

Austria :

Austrian Federal Railways.

Belgium :

Belgian National Railways;
National Light Railways Company, Brussels;
Belgian Railway and Enterprise Co.;
Upper Congo to the Great African Lakes Railway;
Colonial Transport Office (OTRACO).

Denmark :

Danish State Railway;
Aalborg Private Railway.

Spain :

Red Nacional de los Ferrocarriles Españoles.

Finland :

Finnish State Railways.

France :

French National Railways Company;
General Light Railways Company, Paris;
Parisian Transport Company;
Algerian Railways;
Gafsa Railways;
French West African and Togo Colonial Railways (Ministry of Overseas France);
Franco-Ethiopian Railway from Djibouti to Addis-Abeba;
Morocco Railway;
Indochina and Yunnan Railways.

Greece :

State Railways;
Thessaly Railway.

Italy :

State Railways;
North of Milan Railway;
Azienda Tranviara Municipale, Milan;
Compania delle Ferrovie Danubio-Sava-Adriatico.

Luxemburg :

Luxemburg Railways.

Norway :

State Railways.

Holland :

Netherlands Railways.

Portugal :

Portuguese Railways Company, Lisbon.

Sweden :

State Railways;
Oxelösund-Flen-Vastmanlands Railways.

Switzerland :

Swiss Federal Railways;
Rhaetian Railways;
Fribourg Railways.

Syria :

Damas-Hama Railway;
Syrian Railways, line from the north to Aleppo.

Yugoslavia :

Federal Railways of the Peoples Republic.

(1) In the report that follows, for the sake of brevity, we have used the name of the country to designate those Administrations who were the only ones to reply for the country concerned.

The main part of our report is devoted to Question I-A, as the problems raised under Question I-B only concerned relatively few railways.

Paragraph A of Question I is concerned essentially with new safety measures taken in connection with level crossings owing to the density of traffic, high tonnage and high speeds on the road, and an estimate of the degree of safety obtained by the different solutions employed.

The term « level crossing » covers installations of a very wide range of size, from the level crossing over a line with one or two trains a day to the large level crossings where main roads cut across lines with a hundred or more trains a day (not to mention the crossing of suburban lines and city roads, where frequently the position has

become so complicated that it has been found necessary to make bridges or subways). Simply to find the correct range of equipment from the safety point of view, which at first sight seems simple enough, is very far from being so. It is possible to determine the correct equipment for a given level crossing, but the results cannot be applied to all level crossings as a whole : the system which appears to be 100 % proof against human mistakes, is found to be difficult of application in precisely those cases, where it would be the most useful; the accumulation of technical precautions to meet any failure of the equipment, which is necessary in certain cases, becomes excessive and leads to unjustified expenditure in the simpler cases which are the most frequent.

There may be a temptation to estimate in round figures with the sole object of comparing and classifying the different level crossings the risk of collisions occurring, and certain Administrations are in favour of this. One method used, the chief merit of which is its simplicity (to the extent that there is some degree of accuracy in the road traffic figures) is to express the product of the average number of road vehicles per twenty-four hours by the average number of trains during the same period. This product has been called by some Administrations « the traffic moment ». It is certain that the use of such a number should be co-related to certain conditions proper to the level crossing itself : visibility, character of the traffic, train speeds, etc. The replies to Question 9 show that 50 % of the Administrations accept this « moment » with the above reservation; the other Administrations are against rather than for it, and give their reasons, in particular the fact that the traffic peaks of the roads and railway do not coincide. Germany, in particular, prefers an indication of the time the level crossing is occupied by road vehicles and by railway trains. Sweden is studying a formula which takes into account many parameters (number of road vehicles and railway trains; speed of the trains, visibility, number of tracks, angle of crossing, gradient of the road).

In sum, it would obviously be attractive to try to find a diversity of solutions which at the minimum cost and for the whole range of level crossings would achieve a coefficient of safety well above the minimum admissible. The complexity of the subject leaves little hope of this question being treated on the strictly mathematical lines desired. However, there is a tendency of this sort to be found in the proportion of equipment used or planned in terms of the more or less approximative evaluation of the risks proper to the different categories of level crossing. Naturally, the financial aspect comes into the picture at all times, and the best solution is obviously that saving the most accidents at the lowest cost.

The following pages will show that important investigations and substantial progress have been made during the last few years. However, the opinions of the different railways are not always unanimous, and are even at times contradictory on the results to be expected from any given system or device. This at times complicates the drafting of the summaries.

It should be noted that there is nothing in the replies of a revolutionary nature as regards the trials made or suggested solutions, taking advantage of the possibilities of the most recent technical progress. There is still a vast field here for the inventors.

In general, the conditions under which level crossings work in different countries must comply with public regulations (laws, decrees, orders, regulations confirmed by the security or control authorities). The railway Administrations have, however, a certain latitude to adapt such regulations to the working conditions of their lines and the character of the different level crossings, the latter being generally classified into different categories with this object. We will not go into details about this classification in the different countries, but to make the following pages clear, we will recall, in chapter I, the principles on which the different solutions to allow road traffic to run at the least possible risk at level crossings are based, even if these appear elementary.

The report will then cover, in the order given in chapter I, a documentary part giving the systems, improvements and particularities of all kinds made by the different Administrations in order to increase the safety factor. We will not however go into details but confine ourselves to giving the principles. We will naturally include, as far as possible, the numerical statistics given (complete statistics being in fact very few) and we will make our comments on each kind of question. We will then endeavour, in connection with the second part of Question A, to bring out the tendencies of the different Administrations regarding choice and application of the different solutions; we will try to derive therefrom a general summary concerning the relative safety obtained.

We will not go into details concerning the safety of pedestrians crossing level crossings by the gates at the side of the barriers, nor crossing level crossings for the sole use of pedestrians. It is generally agreed that they cross at their own risk and peril in the case of crossings with keepers.

In any case, the problem of a pedestrian crossing a level crossing is not appreciably different from that of crossing a road. If on the one hand the railway traffic is not able to brake in order to avoid an accident, whereas to some extent the road traffic can, the path of the railway traffic is much more clearly defined and the actual point at which there is a risk for the pedestrian much smaller. In fact, the number of pedestrians involved in accidents is, at least in certain countries, much greater than the number of victims of collisions between road vehicles and trains but such pedestrians are frequently either persons with defective judgment or physique, or children who have not been looked after sufficiently (1).

The above details go to show that our report will not merely be a recapitulation of the answers to the questionnaire. During the work of building up the synthesis we endeavoured to prepare, work which sometimes went rather beyond the framework of the questionnaire, in examining the diagrams or commentaries given by the Administrations in support of their replies to the questionnaire, we sometimes had to seek additional details or precisions to throw more light on the question with which we are dealing. It is possible that unwittingly we have failed to understand the exact idea of the Administration in question. If this has occurred, we make our excuses for it in advance.

(1) Quite apart from suicides.

HEADING I.

QUESTION A.

CHAPTER I.

BRIEF SUMMARY OF THE PRINCIPLES ON WHICH SAFETY AT LEVEL CROSSINGS IS BASED.

A. — Level crossings with keepers.

a) *Level crossings where the barriers are normally kept closed* (1).

This solution consists in normally giving the road users a stop signal by means of the gates or barriers, and having a keeper at the level crossing who only opens the barriers when he thinks the road traffic can cross without risk before the arrival of a train. The keeper usually depends on the visibility, but he may have other ways of knowing when a train is due, such as notices, telephone, etc.

b) *Level crossings where the barriers are normally left open.*

If there is a great deal of traffic on the road, the above system may be difficult to carry out. If the railway traffic is numerically smaller than the road traffic and if, in particular, there are long intervals without any trains, it is very interesting

(1) For the sake of brevity, in the following text we frequently use the expression « closed system » for the system where the gates or barriers are normally left closed, and « open system » for the system where they are normally left open.

both as regards the amount of work involved and the freedom of running of the road traffic, if the barriers can be left open between trains (1). From the safety point of view, recourse can be had to the previous solution by having the level crossing closed by the keeper some time before a train is due. This implies a certain vigilance on the part of the keeper, who must not forget to close the barriers at the proper time, and in addition must be acquainted with the times of all the trains.

In actual fact, the problem is often complicated, as though the timetables give him the times of the regular trains, and even the theoretical timetables of trains diagrammed in case of need, they cannot give him any information about the special trains.

In certain cases, where the visibility at the level crossing is very good, the problem of special trains can be solved by insisting that the keeper be on duty by the barriers all the time, so that he can close them when a train is in sight. But, generally, a solution to this question has been sought either by regulating the running of the trains (obligation to signal special trains from the preceding train), or by making available some method of advising the keeper such as : telephone, warning given manually from a signal box or station, bell, automatic announcement, etc.

The important difference should be noted between warnings given in advance of the running of a special train, either by signal, telephone, or bell, and the *immediate* warning given by automatic announcement (or manual warning) *shortly* before the arrival of the train in question. In the latter case, the level crossing is not actually put under the closed system but the keeper has to shut the barriers before the train arrives and keep them shut till it has passed. In other words, *confidence* is placed in the immediate warning, which gives the device used the character not of an additional precaution as would be the case with a similar immediate warning given to a level crossing normally kept closed where the visibility is poor, but rather of a safety installation, the failure of which would have very serious consequences. Whence the necessity in such cases of having certain guarantees to minimize the possibility of failure.

The current practice with the safety problems before the railway Administrations has naturally led them to give the level crossing problem the same character as that of the crossing of two railway lines, and protect the road and railway using the level crossing by means of signals, preferably interlocked.

This question has given rise to difficulties of application and much controversy. In the main part of the report, we will mention the arguments for and against given by the different Administrations.

c) *Level crossings protected from a distance.*

We will not say much about this system, which generally only covers small level crossings on lines with little traffic. There are some special risks entailed, which we will deal with later.

B. — Level crossings without keepers or signals announcing the trains.

This solution has frequently been adopted, from the time the lines were first opened, in the case of crossings on secondary lines with few trains and roads with little or average traffic. Safety depends on the road user being able to see if a train is coming so that he will not get onto the line if there is any risk and can get off it in time if he sees a train coming. These conditions, which were not closely defined at first, have been the subject of more and more precise regulations in some countries.

C. — Level crossings without keepers where the arrival of a train is shown automatically.

When keepers are employed where warnings are given immediately before the

(1) The decision to adopt the closed or open system is taken sometimes by the authorities and sometimes by the railway company. In certain cases, it is left to the keeper.

approach of a train, the keeper has to obey the order he gets from the train arrival warning by closing the road stop signals (i.e. the barriers), as soon as he gets the order (i.e. the warning), and must only open them when the train has actually cleared the level crossing, which cancels out the warning. Obviously this task can be done by other than human labour, operated by the warning relay and cancellation of the warning relay. The signal can consist either of automatic gates, or notices, or lights, or an audible signal, or, as is more generally the case, a combination of these various devices; the stability of the mechanical device will obviously depend on the working of the signal given.

Is the mechanical device more or less safe than the human? That is the question which arises and which is more important than any other.

On the other hand, the economic aspect of this solution will also come into the picture if the degree of safety is identical.

CHAPTER II.

LEVEL CROSSINGS WITH KEEPERS.

A. — General.

Apart from improvements intended to facilitate the work of the keeper, which will be examined further on, substantial improvements have been made by the different Administrations in the signs warning road users of a level crossing, the visibility of the gates when closed, type of barriers, method of operating the gates, etc.

Warning road users they are approaching a level crossing.

The signs laid down for level crossings with keepers in article 15 of the International Protocol relating to road traffic dated the 19th September, 1949, are in very general use by the Administrations, consisting of a notice « Barriers » on a triangular plate, at least in the case of important roads with much motor traffic. Such signs are often equipped with reflectors or luminous paint. Certain Administrations set up other signs between the distant warning and the level crossing consisting of vertical signs with red stripes on a white or yellow ground giving the distance from the level crossing (art. 46 of the Convention).

Painting the fences near level crossings white makes it easier to see them.

Visibility of the gates when closed.

All the Administrations take great care to make the barriers clearly visible when closed; for this purpose they use red and white or red and light yellow paint.

At night, the general practice is to have reflectors at level crossings where there is motor traffic : catseyes, luminous paint. Sometimes, the barriers are duplicated by a red signal worked by the keeper or automatically lit when the gates are closed.

There are a few level crossings with keepers where there are no barriers and the keeper gives the road traffic the order to stop, but these are exceptional.

Improving the type of barriers.

The use of quick acting lift barriers is increasing. The safety is considerably increased, on the one hand by the smaller damage caused by hitting the barriers, and on the other in particular by the shorter time taken to operate them which reduces the time lag between the time the keeper sees there is no train in sight and the road traffic can move on. The idea of using flexible barriers has been put forward, but has never come to anything. Most of the Administrations consider that lift barriers with nets appreciably reduce the consequences of hitting the gates and that this is sufficient.

Obligations on road users when approaching level crossings with keepers.

These derive from the regulations affecting road traffic, in particular article 12 of the International Convention of the 19th September, 1949 :

« Every driver approaching. . . . . « a level crossing must take particular care « in order to avoid any accidents. »

Risk of running into the closed barriers.

The obligation to take care imposed on road users by these regulations should prevent any accidents of this sort. In actual fact, the road users are not always careful enough, and it is not rare to find drivers, seeing the barriers are just about to be closed, making a dash for it. In this connection, it should be noted that if the keeper can see the road on each side of the level crossing clearly, it makes it much easier for him to operate the barriers, and everything possible should be done to get good visibility from the place where he works the barriers (we will deal later on with the case of distant-operated barriers).

Warning given to the trains of the position of the barriers.

Germany reports that provision has been made to give the drivers warning inductively within braking distance of the level crossing if anything has gone wrong with the barriers. The equipment in question was not described. It appears that it works a signal on the train if the gates are not properly open. We will speak again of this question later on when dealing with level crossings without keepers. The Danish State Railways are also considering giving an indication on the trains of the position of the barriers.

Photograph 1. Improved visibility of a level crossing with a keeper by painting the surrounding fences white.

Damage to the barriers.

The keeper replaces them either by signals or by makeshift devices, ropes, etc., together with lights at night.

Suitability of the keepers.

Checking the suitability of candidates for the post of keeper and that of the

keepers employed for the duties they have to carry out should be taken very seriously.

Though the job of crossing keeper is compatible with certain physical defects, those so employed must have a great sense of responsibility, thorough knowledge of the regulations and great vigilance.

the level crossing to be cleared before the arrival of a train. This system may entail a great deal of work if the road traffic is heavy. Consequently, the choice of the open or closed system will be determined above all by the number of times the barriers will have to be operated in

Photograph 2. — Improved visibility of the barriers when closed by painting them red and white and fitting reflectors.

We will now consider, in the light of the information received, the safety improvements achieved in the working of the level crossings themselves for the different systems of level crossings with keepers.

B. — Level crossings with barriers normally closed.

In this case, the keeper only opens the barriers for the road users after having assured himself that there is time for

each case. Another consideration, however, the actual safety, must also be taken into account. The essential difference between the two systems lies in the fact that with the closed system the keeper has to do something (open the barriers) before there is any danger, whereas with the open system he has to omit doing something (close the barriers) to create the danger. It is certain that at night, if the number of the operations is few, there is a fear the keeper will sleep too soundly with very

serious results, so that as a rule it is better to keep to the closed system at night, even if the road traffic is more frequent than that on the line.

How can the keeper be sure that there is time for the road traffic to pass without risk of collision with a train? The simplest method is the visibility on the line. It is also possible to depend on his hearing, but this is less sure. It will be seen therefore that when the visibility is good the keeper of a level crossing where the barriers remain closed is able to work with safety even if he does not know the train time, which does away with the worry of special trains.

Improving the methods of warning the keeper. — The visibility of the line, on which the safety of this system is based can be bad owing to the position of the crossing, or if there are frequent mists (1); in such cases, the keeper must be warned instead of depending on his sight and hearing. This is done by the various types of warning devices with which level crossings are equipped.

The criteria adopted in fitting such devices by the different Administrations are given below :

Period of visibility of the trains from the road less than :

30″ for the fastest trains : Finland, Aalborg Private Railway;

20″ for the fastest trains : S.N.C.F.

Less definite regulations (2) based on the amount of traffic, have been adopted in Spain, Norway, Algeria, Switzerland (Federal Railways), Italy (State). Other Administrations are systematically making it the general practice to give warning of the approach of a train : Belgium (S.N.C.B.), Luxemburg, Holland, Portugal. Sweden (State) warn the keeper when a train is approaching in one way or another.

The warning is given by the following methods :

Telephone : this also makes it possible for the keeper to ask for information;

Electric bell;

Warning given manually;

Automatic warning given by a pedal, track circuit or other device.

These methods are generally all in use on the different railways. We will see, when dealing with the open system, where such a warning is more important than in the case of the closed system, the present tendencies in the choice of the method of giving the warning.

C.— Level crossings where the barriers are normally open.

As we have already seen, if there is more traffic on the road than on the line, the keeper will have less work to do if the barriers normally remain open; in this case the safety can be assured in several ways :

a) by advising the keeper of the times at which all the trains will pass, which enables him to close the barriers a certain time before a train is due, which is a return to the previous system;

b) by giving the keeper a sure and certain warning of the approach of every train, which enables him to close the barriers when the train is coming. In such a case, naturally, he must not open the barriers again until the train has passed. The method in question may simply be on sight, but in this case the keeper has to be constantly on the lookout. Such a system makes it unnecessary for the keeper to know the train times in advance;

c) by covering the level crossing while the barriers are open by signals given to the trains, such signals being interlocked with the barriers of otherwise. This method means that the keeper must know not only the theoretical time of the trains but also

(1) Special precautions (such as the passengers getting out of motor vehicles) are laid down in the regulations in case of fog.

(2) Certain early regulations such as forbidding the keeper to open the barriers when a train is within a certain distance of the level crossing have been found impossible for the keeper to observe.

that they are actually approaching, otherwise the trains will constantly be stopped by the safety signals.

1) *Closing the barriers a certain time before a train is due to pass.*

This is easy in the case of the regular trains. The work of the keeper is very much reduced with this method, even when the road traffic is heavy, if there are not many trains and only regular trains. But the problem of special trains frequently arises.

Methods used to advise the keeper of special trains.

It is easy to understand that the keeper can be in possession of tables showing all the regular trains, and all the permissive trains whose timing is laid down in advance. So that it is only necessary to advise him of special trains. This is done in various ways. It can be signalled by the previous train or by telephone. In addition, the keeper has to be informed of any special trains, which have not been booked in advance (specials).

This complicates the system and it can only be applied in the case of lines where only a certain number of specials are likely to be run.

On the other hand automatic warning results in a much more flexible solution. As we will see in the following paragraph, such a warning, if given in both directions, may make it unnecessary for the keeper to keep the barriers closed a certain time before the train is due, and completely solves the problem of special trains.

2) *Barriers normally kept open and closed when a train is approaching.*

There is one solution if the visibility is very good : the keeper is on duty all the time and closes the barriers as soon as he sees a train coming; this presupposes that the time taken to clear the road traffic and close the barriers is shorter than the time in which the train can be seen coming with a certain margin of safety. There is however the night and foggy days to be taken into account. Such a simple method usually has its risks. In any case, it is often impossible to apply it. But it is quite another thing when some very reliable automatic warning of the approach of a train is available. For the sake of brevity, we will call such a warning « close warning ». Obviously, in this case, safety depends entirely upon the functioning of the automatic warning. There may be some hesitation in using this method, as it is impossible to be absolutely certain that the device will function properly and on time out in the country (the control equipment will consist in effect of a second warning duplicating the first) (1). This may make it necessary to have two warning devices as we shall see.

The experience of the S.N.C.F. during the 1939-1945 war, when it was necessary to protect many level crossings with a close warning, led to the conviction on this railway that this method was superior to all those considered in the case of level crossings with keepers.

Number of level crossings with automatic warnings at the end of 1950.

These figures would have been very interesting. Unfortunately, it was not as a rule possible to obtain them from the statistics given. Only the following data could be extracted :

Belgium (S.N.C.B.)	7
Denmark (State)	16
Gafsa Railway	3
Portugal	16
Sweden (State)	661

If these figures are compared with those given in the table later on showing the number of automatic warnings installed during the last five years, it appears that the following Administrations have a large number of automatic warning devices : Germany, the S.N.C.F., the Swedish State Railways.

(1) In fact, the question is similar to that of the track circuits used with safety devices. It is the same if the warning is given by the shunting of a track circuit.

It is possible that this conclusion is not accurate, but the information supplied did not make any other possible.

It should be noted that for certain railways such as the S.N.C.B., the Danish State, Luxemburg, Portuguese and Swiss Federal Railways, which have a great many manual or telephone warning systems in use, the value of the automatic warning may appear much less immediate.

Programme to be carried out.

Exactly what information should be given to the keeper and what time should be allowed for the warning?

In general, the warning is given by a bell or trumpet (Germany) duplicated by a sign or light showing the position of reception relay of the warning. On double track lines, the signs indicate the line concerned. Certain Administrations (Germany, Swedish State, and sometimes the S.N.C.F. as well) have a different sound for each direction; others only make use of one sound and indicate the line concerned by the sign (S.N.C.B., Danish State, Spain, S.N.C.F., Algeria, Morocco, Holland and Swiss Federal Railways).

As regards the timing of the warning, there are variations in practice. We get in increasing order, the following intervals between the time the train is announced and the time it runs over the level crossings:

Aalborg Private Railway (Denmark)	25″
Spain	30″
Swedish State	30″
Germany, Finland	40″
S.N.C.B.	60″
S.N.C.F. (and exceptionnally : 40″)	60
S.G.C.F.F. (France)	60 to 120″
North of Milan Railway	60″
Norway	60″
Finland	75
Morocco	90
Netherlands	2′
Gafsa Railway	5

This scale is fairly extensive. If on the one hand, the interval must allow of a certain margin to make sure that the barriers can be safely closed, it is certain, on the other hand, that the road traffic, where this is heavy, will be seriously inconvenienced when slow trains are announced, if the point at which the warning is given is too far off.

In the same order of ideas, question 18 asked if there were any devices to give approximately the same time lag with all kinds of trains. The replies received were negative, although certain Administrations, in particular Spain and the S.N.C.F. recognised the value of this idea whilst stressing its complexity and the cost of solving it.

Question 15 asked what was the time lag after which the warning might be considered to have lost its value. Few Administrations replied to this question, which in fact did not specially concern automatic warnings but rather those given manually. Belgium, Spain and France said 10′, Morocco 5′, Tunisia 8′ and Sweden 5′.

Cancelling the warning.

1) *When should the warning be cancelled?*

It is a question of knowing in fact whether the warning should be cancelled before the train gets to the level crossing (a merely temporary warning being given) or whether the warning should continue in operation until the train has passed. In the first case, there is a risk of the barriers being opened prematurely by a mistake on the part of the keeper, if the train takes a long time to come (slow trains). On the other hand, two trains running shortly after each other will give two distinct warnings. In the second case, if two trains were close together there would be a risk of the warning of the second train being masked by the first if it had run into the warning distance before the warning of the first train had stopped.

The replies received did not make it possible to make any synthesis of the opinions of the Administrations in this connection. It appears however that some of them cancel the warning after a certain time, which gives it the temporary character we have just mentioned, but that the

advantage of keeping the warning in force until the train has passed the level crossing is generally appreciated.

2) *Who should cancel the warning? — Is it the keeper? (Manual cancellation) — Or the train itself? (Automatic cancelling). — Is it done by means of a time device?*

Obviously, a time device is impossible unless it is agreed that the warning needs not last as long as the time taken by the train to approach the level crossing from the point at which the warning is given.

In favour of manual cancellation are :

Germany (who also appears to use automatic time device cancellation);
The S.N.C.B.;
The Danish State (who also use automatic time device cancellation);
The S.G.C.F.E.;
The Aalborg Private Railway;
The Gafsa Railway;
The Franco-Ethiopian Railway;
The North of Milan Railways.

In favour of automatic cancellation are :

Spain;
The S.N.C.F. (very definitely);
The Morocco Railways;
Norway;
Holland, which insists on the possibility of mistakes occurring if several trains follow each other at close intervals;
Swedish State Railways.

Those in favour of automatic cancellation by the passage of the train in line with the level crossing obviously are thinking of the serious risk involved in tardy cancellation by the keeper when a new train has already run into the part of the line before the warning. In such a case, the second train will certainly run onto the open level crossing without any warning being given. Against this, if the warning is cancelled by the train itself other precautions are necessary if this is done by means of a pedal, as wedging the cancellation pedal in the low position would make it impossible to give any further warnings. This risk is obviated by means of a fitting which alters a breakdown in the warning into a premature warning. The keeper seeing that the warning continues, when no train is coming, soon realizes that the device is out of order and takes the necessary precautions, usually by keeping the barriers closed. A similar arrangement can be made if the cancellation of the warning takes place by means of a small track circuit, to meet any failures in the insulation of the circuit.

However, apart from the cases of the brief warning, and in particular of the warning cancelled by a time device working only a few seconds after the warning begins, two trains running close together, when the warning is given automatically by means of a pedal or small track circuit which does not extend as far as the level crossings, always run a risk of overlapping, that is to say the second train may have passed the device that gives the warning before the first warning has been cancelled. In such a case both warnings are cancelled together, and the second train arrives without being announced. It is however fairly easy to overcome such a risk, when the warning is automatically cancelled. In fact, such a risk can hardly occur, in view of the general use of the block section (automatic block or otherwise) except in the case of a second train running at sight, even if it starts (if it is on the block section near the warning device); this second train comes up to the level crossing relatively slowly and it is possible to announce it by means of a further fresh warning device, pedal or small circuit, which even though sited much closer to the level crossing than the other device, nonetheless gives effective warning owing to the slow speed at which the train is approaching. Whenever possible, it is best to place this second device at the limit of visibility of the level crossing, so that in the unlikely case of the warning given by it being also cancelled by the first train, the keeper can see the second train coming. In any case, a track circuit extending from the second warning point to the level crossing will solve the question.

Question 17 raises the case in which road traffic can be inconvenienced by too long a warning time. The question may

arise, for example, on a line run over both by express trains which run past the warning without stopping and other trains which may have to stop after the warning has been given (owing to a station or block section at that point). In such a case, the ordinary method of giving the warning may involve a considerable wait for the road traffic at the level crossing when the keeper is absolutely forbidden to open the barriers. Such a case can be solved by installing a first warning bell rung at the normal warning distance which requires the keeper to close the barriers. This warning is then completed by another nearer the level crossing, sited for example after the station or behind the stop signal. For a certain interval based on the time taken by the slowest train to reach the level crossing without stopping from the warning pedal, the keeper is forbidden to open the barriers. If after this interval, there is no sign of the train and the warning bell has not rung, he can work the level crossing on the closed system, making use of the second warning which, though nearer, is sufficient since it relates to a train that has stopped and the level crossing is working on the closed system. Not many Administrations reported this solution; they were :

Spain, which solves the problem by a track circuit;

The S.N.C.F., which generally solves it by a pedal and gives a period of 60″ for the warning and 40″ for the second warning;

The Algerian Railways, with periods of 75″ and 30″, but rarely make use of it.

The question may be more complicated when the station lies within the warning distance so that the pedal or circuit for the second warning has to be sited in a position where it is liable to be set off or not as the case may be during shunting. It may happen, especially when the station is very near the level crossing, that definite orders may be necessary to obtain liaison between the keeper and the stationmaster. This may be made less arduous by making the warnings depend on the position of certain points or signals. The same type of difficulty will be encountered when we are dealing with level crossings without keepers with automatic road signals.

Method of giving the automatic close warnings.

Generally, except in special cases as we have seen, the close warning is given automatically. The interlocking of the warning takes place either by means of a pedal — or some similar device, for example flexing device (Germany) or a track circuit.

Track circuits can be designed in various ways. It is possible to design a track circuit extending over the whole of the distance of the warning and working either throughout or not at all. The warning relay is de-energized as long as the circuit is occupied, and this causes the warning bell to ring; it is re-energized as soon as the circuit is freed. In this way the warning is automatically cancelled.

It is also possible to have the warning given at the beginning of the distance concerned by a small track circuit, acting in this case on the same lines as a pedal. In this case another device, such as a hand-operated pedal or track circuit is necessary to cancel the warning (1). This latter method of giving the warning gives rise to the same objections as those reported above in the case of warnings given by pedal in the case of trains following close after each other, whereas the continuous track circuit working all the time or not at all solves the question without further complication.

The use of track circuits means that the lines must be run over only by vehicles capable of shunting them properly and no others. This is not always the case with light railcars and trolleys unless such vehicles are specially equipped. In certain cases the S.N.C.F. uses track circuits and pedals side by side.

In addition, the installation of warnings

(1) It is also possible in the case of a long track circuit to make the track relay merely de-energizes the warning relay; the warning is cancelled by a pedal, and in practice .we fall back on the case of giving the warning by means of a pedal.

by means of track circuits is complicated in the case of lines already equipped with the automatic block. So as not to have too many interruptions of the circuits, those already installed are sometimes used, even though they do not correspond to the optimum warning periods nor the best distances for the cancellation of the warning. Naturally, such difficulties are reduced when fitting a block line with track circuits and the necessary warnings at the same time. It is also possible to arrange for the track relays only to cut off the warning relays, as stated in the footnote (1).

Whether pedals or track circuits are used, the automatic warning devices used in simple cases at the present time, are all based on the following principles : the cancellation of the warning de-energizes a warning relay whose lower contacts feed a bell, and generally some visual signal. If the warning is given by a pedal or short circuit, the circuit feeding the warning relay generally passes through one of the upper contacts of the latter so that the fugative breaking of the relay means that it cannot close until a further operation has taken place. This is done by the device cancelling the warning, and until this latter has operated, the warning continues. Germany however makes use of a device operated by the flexion of the rail, working on principles rather different to those described above. In the case of the long track circuit which is either open or closed, the level crossing relays are de-energized by the shunting and re-energized by the suspension of the shunting as we have said. We will not go into further details of the layouts involved with these programmes.

The following table gives the number of automatic warnings installed in the last five years by the different Administrations, as well as a few brief details about them.

Failure of the automatic warning.

Safety depends essentially on the working of the warning. We will consider the risks occurring, first of all in the case of pedal devices, then with track circuits.

(1) See footnote on the preceding page.

Worked by breaking the current. — In the case of pedal devices it is essential that the transmission of the warning should be made in such a way that the indication « Danger » is given by cutting off the current, as there is a much greater risk of the current being cut off or earthed than of the current being switched on. There is some risk of this of course, but it can be minimized by the use of insulated wires.

Damage to the warning pedal. — We have seen that any device, which enables the keeper to ascertain that the pedal giving the warning has not functioned when the train passed over it, is in practice a warning in itself. Under these conditions, the use of two warning pedals in series has been considered. This is not absolutely general. (We will remind readers once again that with an automatic warning in the case of a crossing working on the closed system there is much less risk, and consequently far less need for any precaution of this kind.) When double pedals are used and inspected sufficiently frequently by the maintenance staff, it can be stated that the risk of failure due to damage to the warning pedal is extremely small; on single track lines where pedals run over in the trailing direction must not cancel the warning, there are generally two arms, the action of one of which cancels that of the other in one direction of running. It is necessary to be careful about vibrations which on the approach of a short train might prematurely effect such a cancellation for the train to be announced. Here again, with double pedals, the probability of this occurring in both cases is infinitesimal.

Damage to the pedal cancelling the automatic warning. — It is very serious if the pedal becomes wedged in the position cancelling the warning, as this makes it impossible to give any new warnings. It is easy to turn such a failure into a premature warning as has been mentioned already. (A similar problem with a solution of the same kind occurs in the case of cancellation by push button.)

Failure due to the line. — We have seen that

Number of automatic warning equipments installed in the last five years.

ADMINISTRATION	Number of automatic warning equipments	ARRANGEMENTS USED
Germany	296	Contact by the flexion of the rail — device duplicated — control button — works by breaking the current — cancellation of the warning and resetting.
Belgium (S.N.C.B.) . . .	not given	Warning by short track circuit — works by breaking the current — cancelled and reset by button.
Denmark (State)	9	Pedal — works by breaking the current — cancelled and reset by hand operated key.
Aalborg Private Railway . .	2	No details given.
Spain	not given	Track circuit (apparently a long circuit) extended beyond the level crossing (to give a warning in case of backworking).
Finland	3 (plus 8 earlier ones)	No details, but state that they prefer track circuits.
S.N.C.F.	1820	Warning pedal — insulated wire at least in the case of important crossings — working by breaking the current — in principle automatic cancellation and resetting by pedal — sometimes track circuit used in conjunction with pedals or by itself.
S.G.C.F.E.	3	Pedals.
Holland	10	Track circuit as far as possible — works by breaking the current.
Sweden (State)	200	Small track circuit — works by breaking the current — automatic cancellation and resetting to normal.
Switzerland (Federal Rys) .	12	Track circuit or pedal — line in cable. — Cancelled by hand or automatically.

such a failure is turned into a premature warning when it is a question of a break or earth, and that the risk of the current being restored is overcome by the use of insulated wires. The risk of the current being restored is however very slight as a general rule, and the use of insulated wires is not general.

The remarks made above in connection with pedals also apply to some extent to other devices working by contact. We will now deal with track circuits.

Track circuits. — When a long track circuit is used over the whole distance during which the warning is given, the only risk of failure in practice is that the circuit will not be shunted by trains of light vehicles. This risk must be regarded as serious on lines where there are long intervals between the trains and oxydization of the rail surface is likely to occur. If such lines are regularly run over by vehicles which have difficulty in shunting the circuits, we think it advisable to give up using track circuits and either use pedals or pedals and track circuits in conjunction.

In the case of a short track circuit acting rather like a pedal for giving the warning, other than the risk of failing to break the current mentioned above, there are all the other risks mentioned in connection with pedal devices, and these can be overcome in the same way (working by breaking the current, if necessary installing insulated wire, turning a failure into a premature warning).

Failure of the relay. — This risk has become extremely small in view of the quality of present day relays.

Failure of the bell. — To appreciate the risk involved thereby, it should be noted that in general there is a sign or light controlling the relay showing which track is concerned in the case of double track lines, and duplicating the bell. Obviously, the bell can only be rung by sending current through it. It is possible therefore to work the bell from two distinct sources of current, or to use duplicate bells worked from the same source and completed by a third bell with its own source of current. This accumulation of precautions is not general.

Comparison
of the automatic warning with that given manually by telephone or other means.

The information given by an automatic warning is more precise than that given manually, the period of the automatic warning lying within a scale well known to the keeper according to whether it is question of a fast or slow train. There does not appear to be any greater risk of failure with an automatic warning than there is of a manual warning being forgotten or failing. In fact, we are strongly inclined to believe that the opposite is the case.

Finally, experience has shown that in difficult cases : presence of a shunting area, and in particular a station lying within the warning distance, there is often a technical solution possible which makes it unnecessary for the keeper to be in touch with the station signalling staff, and in any case if the site is such that this is necessary, the installation of an automatic warning will still further increase the safety.

On the whole, the foregoing report shows that in the case of an automatic warning by pedal or track circuit, there are a whole series of precautions that can be taken, and the size of the installation can be made to correspond with the importance of the level crossing.

The conclusion resulting therefrom is that the functioning of such devices is now very certain. Accidents due to failure of the warning are very few, and in any case much fewer than those caused by mistakes on the part of employees, as we shall see from the statistics given later on.

Method of working
when the train runs through the level crossing in the reverse direction.

Special measures are taken to inform the keeper of the installation of the reverse running, as with all systems of working level crossings with keepers. However in Spain the problem has been solved when

the warning is given by means of a long track circuit by prolonging the circuit well beyond the level crossing, which obviously delays off the cancellation of the warning but also makes it possible to give a warning for a train coming in the opposite direction.

3) *Covering the level crossing when the gates are open by means of railway signals interlocked or otherwise with the barriers* (1).

This procedure appears attractive at first sight. The level crossing is made to comply with the usual regulations for cross-over lines. To be complete it should include on the one hand permanent interlocking, and on the other, to overcome the grave risk of the barriers being opened after a train has passed the distance signal at line clear interlocking with the warning. The latter risk is stressed in particular by Spain in the case of double track lines when a train from the opposite direction appears soon after the first train has passed the level crossing.

From reading the replies to question 8, it appears that signals are used to cover this case on a certain number of railways, but are not the general practice on any of them, viz : S.N.C.B., Spain, Italian State, Luxemburg, Holland, S.N.C.F. (very rarely) and Swedish State.

Germany is considering in the future giving the driver a warning by induction, advising him within braking distance of the level crossing if anything is wrong with the gates. This device, which was not described, appears to be roughly equivalent to a covering signal.

The interlocking of the railway signals with the barriers is not considered by some of the Administrations using it as a practice to be generalised.

— The S.N.C.B. uses it on level crossings where the road traffic is very heavy (mechanical or electrical interlocking).

— In Spain on lines with the automatic block the adjacent signals are freed when the barriers are open; on such lines, when they are double track lines, the closed barriers are locked electrically on the approach of a train.

— The S.N.C.F. only releases the signals very exceptionally and in principle will not do so in the future.

— The S.G.C.F.E. releases some of the protecting signals very exceptionally when the barriers are opened on some level crossings.

— The Italian State uses interlocking in the case of a level crossing worked from a signal box and also in the case of important level crossings.

— Holland uses interlocking exceptionally at level crossings with heavy road traffic.

— The Swedish State also interlock the signals with the open barriers; in certain cases, they also interlock the barriers when the train comes within the specified covering distance.

— The Swiss Federal Railways only use it near stations.

The value of interlocking is stressed by the Spanish Railways, but they consider that this makes the installation very costly. The device sometimes used in Sweden appears to be equivalent to interlocking.

It may be wondered why covering level crossings by interlocked signals or other signals is not more generally used.

Simply covering a level crossing with little or average road traffic by fixed signals from a station when it is near the station is quite safe and results in economies on lines with little traffic as it makes possible the open system with complete safety with the additional protection of signals, whilst there need be no keeper other than the station staff who are fully cognisant of the train times on small lines. But apart from such cases, the method has serious inconveniences. First of all, the keeper must be thoroughly cognisant not only of the theoretical times of the all the regular and occasional trains as well as when the latter

(1) This procedure is not necessarily reserved for level crossings operating on the open system.

are run, but also of the exact moment they approach the level crossing. There is no other solution than to have a warning close to the crossing (manual or automatic) with a predetermined time lag so that the keeper has time to close the barriers and put the railway signal at line clear before the train can see it; this necessity doubles at the very least the warning period compared with simple automatic warning.

On lines run over by very fast trains as well as slow trains, this soon involves closing the barriers, when there are a lot of trains, to an extent that will inconvenience the road traffic. This point is stressed by Belgium, who sees in it a serious drawback, in spite of the safety value of protecting level crossings by signals.

The risk of the keeper setting the signals against the train, with all the consequences this will have on regularity of running, is a serious matter in itself, as the safety of the trains depends on their regularity.

Finally, what railway signals should be used to protect a level crossing? On lines equipped with the automatic block, it is impossible to multiply the signals in order to protect level crossings; this would involve having unduly short sections. If the existing signals are used, some of the distances would be too great and impossible in view of the time the level crossing would then have to be closed. There remains the possibility of using special signals for level crossings. It is to be feared that the multiplication of signals with different meanings overtaxes the vigilance of the drivers by making their task unduly difficult.

As for the simple interlocking of the barriers and signals, this is illusionary if not completed by interlocking them with the approach of a train or there is nothing to stop a keeper who has closed the barriers, opening them again just as the train is coming, so that the putting of the train signal to danger has no effect.

All these reasons are the explanation why there has not been a great tendency to protect level crossings by means of the railway signals.

D. — Level crossings operated from a distance from another level crossing or a signal box.

The method is obviously used for the sake of economy. Whether the level crossing is working on the open or the closed system, there is always a certain risk of trapping road vehicles between the barriers or of damage by the barriers whilst they are being closed while road vehicles are still in motion. To overcome this, the operation includes a preliminary warning to the road users (preliminary warning laid down by article 47 of the International Protocol), which can also be completed by some other device.

Germany uses lifting barriers, the position of which can be controlled by the keeper.

Belgium (S.N.C.B.) gives a preliminary warning by means of a red light and bell; pedestrians cross through little gates at the side of the crossing.

Denmark (State) gives a 10" warning by means of a bell; the barriers can be raised, and there is room for a vehicle between them and the track.

On the *Aalborg Private Railway*, the movement takes place in three periods; fast, slow, fast.

Spain uses turnstile gates for pedestrians.

Finland gives an 18" warning by bell. There is a clear space of 12 m between the track and the barriers.

The *S.N.C.F.* gives a warning by bell, and sometimes by a sign « Halt ». The closing of the barriers takes place very slowly. There are little side gates for pedestrians.

The *S.G.C.F.E.* and Overseas French Railways have side gates for pedestrians.

Algeria gives warning by sign and bell — side gates.

Italy gives warning by bell.

Luxemburg gives a 15" warning by bell and uses barriers that can be raised.

Holland shows a sign « STOP » 10" before the barriers are closed, and uses barriers that can be raised — sometimes half-gates are also used.

Portugal gives warning by bell.

Sweden (State) gives a 15" warning by bell. Pedestrians caught between the barriers can get under them if they bend down.

Switzerland (Federal Railways) gives warning by bell and uses barriers that can be lifted up and their position controlled.

The operation of level crossings from a distance is however limited to those level crossings where the road traffic is slight.

E. — Problem of trains running in the reverse direction.

Special precautions have to be taken at level crossings with keepers in this case. Such precautions are generally the subject of written orders, the object of which is to advise the keeper as soon as possible. In principle, the level crossing must be operated on the closed system. In general, the speed of the trains running in the reverse direction is limited. We have seen that Spain, in the case of level crossings with keepers with automatic warnings given by track circuits, gives an automatic warning of a train running in the reverse direction by extending the warning circuit well beyond the level crossing.

CHAPTER III.

LEVEL CROSSINGS WITHOUT KEEPERS WHERE THE APPROACH OF A TRAIN IS NOT SIGNALLED.

With this system, safety depends on the road user being able to see whether a train is coming so that he will keep clear of the crossing if there is any danger. Many such level crossings were made on secondary lines at the time they were built. Other level crossings at which there used to be keepers no longer have them owing to the need for economies. The problems arising are as follows :

Signs warning road users they are approaching a level crossing which do not permit any confusion with those at level crossings with keepers.

The replies to question 7 show that, very generally, different signs are used for the two types of level crossings, the signs used being those laid down in the International Protocol of Geneva (Article 15) : some distance away a sign « locomotive » on a triangular plate — at the crossing a St. Andrews Cross with red and white stripes, or red and light yellow. Some Administrations make use of the provision made in article 46 of the Protocol for intermediate signs between the distant and level crossing signs : oblique red stripes on a white or yellow ground, in order to give a more precise indication of the actual distance from the level crossing.

Conditions imposed when suppressing keepers at a level crossing formerly guarded and introduction of system without keepers and without warning when a train is approaching.

It appears that originally such regulations were left uncodified. Obviously they will be based above all on the visibility of the railway line from the road. The frequency of fogs must also be taken into account. Again, on the one hand the amount of traffic on the road and on the railway must be taken into account, and on the other the local or otherwise character of the road traffic. Certain Administrations (S.N.C.F.) assess the importance of level crossings by calculating the traffic moment.

As regards the visibility, a distinction can be made between the immediate visibility, i. e. that of the road user at the level crossing, and on the other hand the visibility at a distance, i. e. that of the road user approaching a level crossing from a certain distance away. The former alone may be sufficient in the case of railways with local trains when there are not many motor vehicles on the road; the second is of greater concern to the motor traffic, and several Administrations determine it by using braking formulae expressing the stopping distance of the motor vehicle in terms of its speed.

The regulations given by the different Administrations vary considerably. Some of them take fixed distances for the road and the line, limiting them if necessary to railway

lines where the speed is below a certain level.

Spain states except on local railways where there is very little traffic, the train should be visible from the road at least 600 m (1 968 ft.) away in the case of maximum speeds of 70 km (43 miles)/h and 800 m (2 624 ft.) for higher speeds.

France. Level crossings with only local road traffic must conform to the following points as regards the immediate visibility : a visibility of 20″ for an observer 5 m (16′ 5″) away from the nearest rail; this distance of 5 m can be reduced to 3.5 m (11′ 6″) when the keeper's house is in the way, and the 20″ visibility can be reduced to 12″ if the level crossing is not used by large flocks nor very long loads.

In the case of level crossings, where the traffic is not only local, in addition to the immediate visibility of 20″, the track must also be visible for 20″ within the braking distance of motor vehicles.

Gafsa Railway limits the speed at which road traffic approaches a level crossing to 40 km (25 miles)/h so that vehicles can stop 10 m (32′ 9″) from the line.

Morocco uses a fixed braking distance of 55 m (180 ft.) and fixes the distance at which the line is visible at 278 m (912 ft.).

Holland decides the zone of visibility by using a theoretical lozenge the half-axis of which are 20 m (65 ft.) along the road and 500 m (1 640 ft.) along the line.

Belgium has solved the problem, at least in certain cases, without giving precise details about the distance nor the visibility, but by making the trains approach the level crossings very slowly (5 km [3 miles]). Such a step can obviously only be taken when the way the line in question is operated makes it possible (in Belgium so-called « local » lines).

The braking formula given by *Germany* is as follows :

$$d \text{ in metres} = \left(\frac{v}{3.6}\right)^2 \times \frac{1}{2b} + \frac{v}{3.6} ;$$

v = running speed of the road vehicle in km/h;

b = deceleration in metres/sec² due to braking;

Denmark (State) uses a formula such as :

$$d = \frac{V^2}{254u}$$

the coefficient u varying between 0.25 and 0.40, and adding a distance of reaction = $\frac{vt}{3.6}$ in which t is about 3″.

The *S.N.C.F.* and the *S.G.C.F.E.* until recently have used the formula :

$$d \text{ in metres} = \frac{v^2}{100} + \frac{v}{1.8}$$

v being in km/h.

The *S.N.C.F.* will doubtless in the future use the formula :

$$\frac{v^2}{5} + v$$

v being in myriametres/h.

It should be noted that acts passed by the public authorities (laws or regulations) can considerably facilitate the realization of the conditions needed by making it necessary to keep trees loped in the vicinity of level crossings and clearing away anything that impedes visibility in the triangular zones affecting the visibility of the road from the line. There are already some such regulations in force and the utmost profit should be made from them.

In the same order of ideas, it is desirable that the regulations should make it possible to set a limit on the speed at which road vehicles approach level crossings.

Use of the train whistle. — Adding to the warning given by the train headlights.

The use of the train whistle on coming to a level crossing without a keeper, or some other audible warning is required whatever the visibility (with some reservations to meet the complaints of those living near the crossing in populated areas) by the following Administrations :

Germany : (18″ warning by bell or whistle, or sometimes both together);

Aalborg private Railway;

Spain;

S.N.C.F. : (except for level crossings with less than 5 road vehicles daily);

S.G.C.F.E.;

French Overseas Territories;

Franco-Ethiopian;

Indochina and *Yunnam;*

Luxemburg;

Norway;

Portugal;

Switzerland (Federal Railways);

Syria (North Aleppo).

Other Administrations only require the train to whistle when the visiblity is bad :

Belgium (S.N.C.B.);

Denmark;

Finland;

Gafsa Railway : (tends to extend the obligation);

Greece;

Italy (State) : (at important level crossings);

North of Milan Railway;

Holland;

Sweden.

When it is foggy, Denmark and Sweden require the train to whistle at all level crossings without keepers, and Holland at all level crossings whether they have keepers or not.

A certain number of Administrations have endeavoured to increase the effectiveness of the train whistle :

Germany: trials of sirens;

Aalborg Private Railway: use of coded sounds;

S.N.C.F. and *C.G.C.F.E.* are considering the use of longer blasts;

Franco Ethiopian Railway is increasing the power of the whistle on up-to-date stock;

Portugal uses a whistle with 5 notes;

Norway increases the power of the whistle on the very fast trains.

Finally as regards the warning given at night by the headlights of the locomotive :

Germany is making trials of 3 lamps for locomotive headlights, one with a moveable reflector throwing a double beam;

Denmark (State) is increasing the headlights by using electric or acetylene lights;

Spain uses electric headlights;

S.N.C.F. uses electric headlights and fits them high up on the locomotive;

S.G.C.F.E. uses electric headlights;

Morocco uses powerful projectors for headlights;

Sweden uses three electric projectors, one of 250 W and two of 40 W.

Improving the visibility of some railway trains (railcars).

Improving the visibility of railcars by day by using paint of suitable colours has been the subject of studies by certain Administrations.

Position of level crossings coming under the classification of level crossings without keepers since the building of the line.

The classification of these level crossings without keepers was generally decided at a time when the regulations were not so stringent and motor traffic non-existent, and they can give rise to serious problems when the road traffic increases.

First of all, it is generally uneconomic to provide them with keepers. Solutions such as the following may be sought :

— reducing the speed of road vehicles coming up to the crossing;

— reducing the speed of the railway trains.

The first solution reduces the distance over which the road vehicle coming up to the level crossing must have good visibility over the line.

The second solution increases the time the train is visible on the line.

Combining both solutions if necessary, some of these level crossings can be brought within regulations.

If such measures prove insufficient, it may be necessary to consider equipping the level crossing with automatic warning of the approach of trains.

In any case, it is obvious that it would not be fair to make the railway support the cost of turning the level crossing into a higher category one with more equipment.

Finally, and we will find the same question arises in the case of level crossings without keepers with signals, the very fact that safety depends upon the faculties of observation of the road user means that certain road traffic, such as droves, must be the subject or strict regulations and that such regulations are enforced. Article 8 of the International Convention of Geneva left it very largely to the different States to regulate the circulation of flocks and herds. It does not appear that the question of crossing the line has always been regulated very precisely.

CHAPTER IV.

LEVEL CROSSINGS WITHOUT KEEPERS WHERE THE APPROACH OF TRAINS IS SIGNALLED AUTOMATICALLY.

This brings us to one of the very important parts of Question I-A.

Replacing the keeper, the human factor, by a mechanical factor between giving the warning and showing a signal to the road user raises a question of security and a question of economy.

It already appears that the savings obtained from doing away with keepers will not pay for the cost of installations in the case of lines with very little traffic, where none but regular trains run and it is possible to obtain the services of a keeper simply by providing him (or rather her) with a house which is already there and a small wage since the duties involved are small. But this is obviously not the core of the question.

For several Administrations, the solution of a level crossing without a keeper with automatic signals seems to increase the safety whilst reducing the cost.

In fact, we were struck by the reiteration of mistakes on the part of keepers that had led to serious accidents at level crossings where the keeper was given an undisputed warning of the approach of a train. It is therefore not paradoxial to hold that from the point of view of safety alone, replacing the keeper by a mechanical device is worthy of consideration. But are such mechanical devices better than a keeper in every case? Does not the mechanical device have other drawbacks?

We have already raised the question of cattle in the previous chapter. It also arises in this case. Certain Administrations also stress the fact that children, especially schoolchildren use the crossings. Finally, it should be noted that certain cases seem to be excluded, at least for the time being : such as level crossing situated near stations where the complication of the warning devices would make them difficult if not impossible to use.

It results from the foregoing that it is not a simple matter to define the practical limits of application of this system. After careful examination and comparison of the opinions expressed by the various Administrations consulted, we will try to formulate certain conclusions about this matter.

Before going into more details on the question, we will indicate summarily those Administrations who already have a substantial number of installations of this kind, owing to the value such experience gives to their opinions. They are :

Germany ;

In service : 146.

Proposed : 8 000 + 2 000 with automatic barriers.

Belgium (S.N.C.B.) ;

In service : 350.

Proposed : 30 a year.

Denmark (State) ;

In service : 175 and 715 devices in service on private railways.

Proposed : 50 and 100 on private railways

Aalborg private Railway ;

In service : 55.

Proposed : 10 to 20.

Norway ;

In service : 23, 5 of which have half barriers.

Proposed : 20.

Holland ;

In service : 64.

Proposed : 25.

Sweden ;

In service : 1 055 automatic signalling devices, 3 entirely automatic barriers.

Proposed : 125 automatic signalling devices, 3 entirely automatic barriers.

Switzerland (Federal Railways);

In service : 45.

Proposed : 20.

The S.N.C.F. has only three installations in service at the present time, but 1 000 are planned, 200 of which will have half barriers.

A. — Principles of the programme to be carried out.

In substance, the object is to give automatically the road user a signal showing the indication « Danger » when a train is approaching the level crossing. But there is no unanimity between the Administrations on the various points of this programme.

First of all, it appears that this signal, though in certain cases only one signal is needed for both directions of running of the road traffic, should preferably be doubled, each signal being placed at one side of the line; this being imperative in the case of a double track line.

1) *Should a positive « line clear » signal be given when no train is approaching the level crossing?*

Different replies were received to this question from Administrations having experience of the method. Germany does not use such signals. Denmark points out that it is impossible to give a positive line clear indication with 100 % safety, and considers such a signal dangerous. Switzerland also, for the same reasons, to which she adds the increased cost of installation and maintenance and the question of the railways responsibility. On the other hand, Belgium considers it necessary in order to make accidental extinction put the signal to danger. For much the same reason, Norway thinks it useful in order to show that everything is all right. Holland considers it useful in order to make a distinction between such level crossings and level crossings without keepers without signals.

The S.N.C.F. amongst those Administrations, which have to date no extensive experience of this arrangement, considers it inadvisable by showing a line clear indication to encourage motorists to accelerate at level crossings against the Highway Code (1) which recommends prudence at such places. Spain would use it if it was not otherwise clear that anything had gone wrong, but thinks it dangerous.

Sweden shows line clear signal at the present time, but the question is very controversial and has been submitted to the Government. A résumé of the discussions was given, stressing that these made a point of the reactions of local and non-local users : in the case of an installation without a line clear indication, when the red light goes out, the non-local user thinks he has come to a level crossing without a keeper without signals and takes the usual precautions : the local user on the contrary, who knows the signal, thinks there is no danger and so runs a serious risk. The latter would not be liable to make a mistake if there was a line clear indication.

The Swedish reply however pointed out that the quality of present installations considerably reduces such a risk.

We will see hereafter how by duplicating the light by a signal the above-mentioned risk can be much reduced.

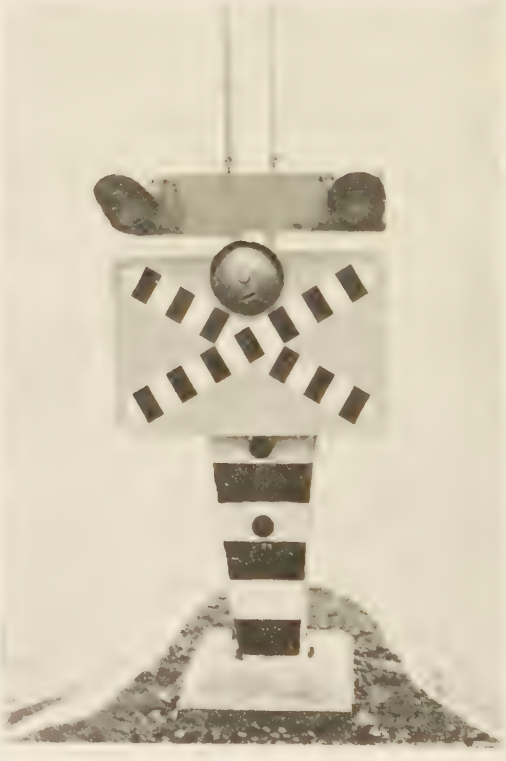
(1) And in addition article 12 of the International Convention.

Photograph 3. — S.N.C.F. Automatic signal in the « DANGER » position (red winking lights, bell ringing and sign up).

All the arguments put forward whether for or against have their value. Personally, we are in favour of doing away with the line clear indication.

The safety arguments against the use of the line clear indication are in fact very much to the point; certainly when anything goes wrong that interferes with the safety, it is more dangerous to be showing a positive indication that the line is clear than no indication at all. In addition there is the « economy » argument. Finally, it is possible to find a solution for the various difficulties arising when there is no line clear indication as put forward by Belgium, Norway and Holland, and to the argument put forward by Sweden in this respect. For example, with the Ervy-Le-Châtel device used by the S.N.C.F., where the indication « DANGER » is given both by a red light, a bell, and a sign « Look out for trains — DANGER », this sign automatically appears when anything goes wrong and the light is out or the bell fails to ring, or the current to the sign is cut off. The presence of the sign alone without the light or the bell means that something has gone wrong (1). If the whole device is out of

1) The road users must naturally be educated in the use of these signals. The two photographs attached show how the signal looks when at danger (light on and bell ringing) and when the line is clear.



Photograph 4. — S.N.C.F. Automatic signal in the position showing that no train is approaching the level crossing (lights out, bell silent, and no sign showing).

View of the level crossing as a whole

View of the signal and of the barrier.

Photograph 5. — Swedish State Railways.
Level crossing with automatic light signals and automatic barriers.

order and neither the light, bell nor sign are working, the signal « DANGER » continues to be shown.

As for the distinction between level crossings without keepers and level crossings without keepers equipped with automatic signalling, this can be given by the signal itself, even at night, at least in the case of

motor vehicles, which after all are the most usual vehicles to use the crossing, since they all have headlights. In fact this was a question which could not be decided by the International Convention of 1939. Perhaps the difference could be shown on the distant road signal.

2) *Character to be given to the « DANGER » signal.*

A priori this appears as a stop signal, especially in the case of a barrier or half barrier.

Belgium and the S.N.C.F. indicate that they consider it to be a permissive stop signal. Even the half barriers have not an absolute character, and furthermore the distant signals for these level crossings say « Locomotive » and not « Barriers ».

In view of the possibility of things going wrong, it does not appear possible to look upon these signals as other than permissive stop signals. Article 49 of the International Protocol of the 19th September 1949, describes this signal as a signal giving warning of the approach of trains and indicates that it requires the road users to stop. There does not seem to be any contradiction between this definition and the permissive stop character of the signal which must be given to such signals.

The Swedish State has fitted some automatic barriers with fixed red lights. This makes it definitely a stop signal. It means that precautions must be taken so that a keeper can quickly be provided if anything goes wrong.

3) *Kind of light to be used. Duplication by an oral signal.*

The danger signal is a winking red light; this conforms with article 49 of the above Protocol (1). The fact that some road users are colour-blind has not been overlooked by some Administrations who make use of a line clear signal, so that in such cases the latter signal has a different periodicity to the « DANGER » signal. Some Administrations use two winking red lights for the « DANGER » signal. Denmark and Sweden use three.

Multiple lights wink simultaneously or alternately.

The duplication of the « DANGER » light signal by an oral signal is used or recommended by all the Administrations who replied, except the Danish Aalborg, Spanish, Franco-Ethiopian and Indochina Railways. Germany does so when there are at least two tracks. Belgium (S.N.C.B.) uses a bell. Denmark uses a bell wherever there are many pedestrians using the crossing, and Finland a bell with 110 rings a minute; the S.N.C.F. uses a loud bell; the S.G.C.F.E. do not think a bell much use except for pedestrians, as for motor vehicles to hear it, it would have to be very loud; Algeria and Tunisia are in favour of an oral signal; Norway uses electric bells, Holland bells, Sweden very loud bells, and Switzerland (Federal Railways) a bell whose rhythm corresponds to that of the winking lights.

There is a great deal to be done before any degree of standardization is achieved.

4) *Use of barriers or half barriers in addition to the « DANGER » signal, especially in the case of double track lines.*

Level crossings where there are no keepers but only automatic warning of the approach of a train may lead to a certain amount of risk in the case of double track lines, due to the fact that the road user is tempted, no matter how long the warning lasts, to cross as soon as the train has passed without making sure that there is not another train coming from the opposite direction. Half barriers on the right of the crossing appear to solve this question. However, the opinions expressed about this differed to some extent.

The following Administrations consider that the warning signal is sufficient without barriers nor half barriers, even in the case of double track lines.

(1) Sweden however has some automatic barriers with a red signal, in which case the red light is fixed. The photogaph shows an installation of this type.

Germany : with the reservation that the road user is given an additional warning if a train is coming on the other track as well (no indication of how such a warning is given).

Belgium (S.N.C.B.) : with the reservation that safety campaigns are periodically made through the press, especially for the sake of schoolchildren; considers that it is an advantage if the back of the red light is visible.

France (S.N.C.F.) : replied in the affirmative. (Make provision however for half barriers in the case of level crossings whose traffic moment lies between 3 000 and 5 000).

Algeria : affirmative reply.

Overseas France : affirmative reply. However half barriers are provided at level crossings with a heavy traffic moment.

Luxemburg : affirmative reply.

The following Administrations expressed different opinions :

Denmark (State) : considers that the absence of barriers or half barriers is not a very satisfactory solution.

Spain : considers the matter very difficult, as when there are only light signals there is only passive obedience to the signals; inclines towards the use of half barriers and stipulates that there should be an indication : single track or multiple tracks.

Finland : stresses the importance of this question.

Holland : thinks that lights by themselves may be sufficient if the road users are sufficiently disciplined and there is not too much traffic at the level crossing.

Sweden (State) : considers that automatic signalling by light signals alone is insufficient on double track lines. They did not however state whether they thought the use of half barriers was an adequate solution.

Switzerland (Federal Railways) : has only one arrangement on a double track line. The signal is completed by luminous arrows and the figure 2 as shown in the drawing they sent.

Morocco : definitely considers that half barriers are necessary.

Norway : considers that it depends on the level crossing.

Sweden's opinion which is definitely negative in character is of added value in view of the experience this Administration has had of automatic signalling devices. It will perhaps be possible to ascertain during the discussions to what extent their experience on double track lines has led to this conclusion. Morocco moreover agrees with Sweden on this subject.

Apart from the opinion expressed by Sweden and Morocco, the following conclusions might be expressed :

1) in the case of double track lines; it is essential to have a signal on each side of the railway;
2) it is advantageous to advise the road user by one means or another (arrows, signs) when there is more than one track; doubling the lower arms of the St. Andrews Cross is one way of so doing that can be recommended;
3) half barriers or barriers can prove a satisfactory solution in the case of level crossings on important double track lines. (Such level crossings could perhaps be defined according to their traffic moment.)

It should be noted that the installations including a pair of half barriers on the right hand side in the direction of the road traffic solves the risk of imprisoning road vehicles in between the closed barriers and is thus much safer than the usual barriers. This risk is also diminished by the warning given by the lights before the barriers are lowered.

It should also be noted that to minimize the consequences of running into the half barriers, the S.N.C.F. provides them with flexible supports.

5) *Length of the warning to be given. — Succession of the different aspects of the signal. — Case in which half barriers are provided in addition.*

The following table gives the length of the warning given in the order of the length of time.

There is considerable variation in the duration of the warning, though most of the Administrations, especially those with experience of such installations, make use

ADMINISTRATION	Signal without half barriers	Signal with half barriers or barriers		
	Minimum duration of the warning	Minimum duration of the warning by the lights	Duration of the warning given by the lights before the barriers begin to close	Time taken to close the barriers
France, S.N.C.F., . . .	20″	25″	8″	12
S.G.C.F.E.	20″			
Algeria	20″			
Luxemburg	20″			
Belgium (S.N.C.B.) . .	25″	No half barriers		
Denmark (State) . . .	25″	25″	15″	No reply
Holland.	25″	25″	10″	No reply
Switzerland (C.F.F.). .	25″			
Germany	27″	Expressed no opinion		
Spain.	30″	At least 40″	No reply	
Finland	30″	No reply		
Franco-Ethiopian. . . .	30″	No half barriers		
Norway.	30″	No reply		
Sweden	30″ (1)	Not stated	15″	20″
Overseas France	60″ 30″ of which show the orange light			
Morocco	90″			

(1) There is some question of reducing this period to 20″.

of the 20 to 30 second warning. Certainly the warning should not last too long. The figures given naturally relate to the fastest trains; they are therefore twice or three times as long in the case of the slow trains. If the period is unduly long, the motorist is tempted to disregard the signal. This difficulty has led to the idea of having an

unvarying warning period which will be gone into later on.

Few replies went fully into the question of the time taken to operate the barriers or half barriers and the warning given before they started to close. It appears however that when there are barriers or half barriers the duration of the warning should be at least 25 seconds for the fastest trains and there should be an interval of 8 to 15 seconds before the barriers or half barriers close. The information available on the time taken to close the barriers or half barriers was insufficient to build up any synthesis of the opinions of the Administrations on this point. The information received from the S.N.C.F., who answered all the three questions, shows that half barriers are closed 5 seconds before the arrival of the train at the level crossing.

6) *Ways of preventing road users from being tempted to ignore the « DANGER » signal regardless of the consequences.*

Having an unvarying warning period is aimed at or recognised as desirable by Germany, Spain, the Gafsa Railway, Overseas France, the Franco-Ethiopian, Luxemburg, Netherlands, Swedish and Swiss (Federal) Railways. But several of these Administrations are worried by the technical difficulties and the high cost.

The Swiss Federal Railways have undertaken research work on this point. The S.N.C.B. have given it up on account of the prohibitive cost. The S.N.C.F. are considering its immediate use but are still studying the question. Denmark, Finland, the S.G.C.F.E., Algeria, Morocco, and Norway have given it up.

On the other hand, to overcome the temptation to cross over the level crossing in the case of a double track line as soon as one train has passed, without taking care that no train is coming from the opposite direction, it appears advantageous to cancel the warning as soon as the last vehicle on the train has passed the crossing. With the exception of Morocco and Norway, all Administrations consulted were in favour of this.

Difficulties obviously arise from the fact that there are long trains and short trains (railcars, light engines). The S.N.C.F. reported the solution they have perfected in their Ervy-Le-Châtel device.

The warning is given by means of pedals. The cancellation of a warning involves the use of a pedal 50 m (164′) before the level crossing. In addition to the cancellation pedal there is an insulated track circuit from the pedal to the level crossing, i. e. 50 m long. This device enables the warning to be cancelled :

a) by long trains which work the device well after the pedal has been pressed down and the track circuit freed, i. e. very shortly after the last pair of wheels has cleared the level crossing;

b) by short trains, if they do not shunt the track circuit well, after the pedal has been pressed down, i. e. in practically the same period.

The installation is based on the fact that the track circuit prevents the pedal from cancelling the warning as long as it is occupied.

Naturally, the recommendations made by the various Administrations for campaigns to educate the public should also be taken into account.

7) *Checking the working of the road light signals on the trains. — Protecting level crossings by railway signals.*

Devices on these lines are provided by certain Administrations.

Germany : In the case of new installations for the benefit of the engine driver there is a signal at braking distance from the crossing indicating that the red winking lights are protecting the level crossing. If anything goes wrong with them, the driver is warned thereof and has to reduce speed and cross the level crossing with care. The installation was not described.

Denmark (State) uses a control apparatus visible from the train showing the position of the road lights. They state that this is

sited 150 m (492 ft.) from the level crossing and can be seen 300 m (984 ft.) away.

Norway indicates that they make use of reciprocal interlocking between the automatic road signals and the station exit signals, without giving further details on the frequency of such installations nor details regarding them.

Sweden has automatic barriers at some level crossings interlocked with the signals on the line protecting the level crossing.

Here the idea is not only to advise the trains how the automatic road signals are working, but to give them time to reduce speed before getting to the level crossing if anything is out of order. Sweden goes still further and protects the level crossing by train signals when automatic barriers are used.

Like the protection of level crossings with keepers by signals, this idea appears attractive a priori. But it needs analysing.

First of all, like the question of protecting level crossings with keepers, it raises the question of the signals to be used. Even more so than in the former case, it appears that it is impossible to give this protection other than by a signal sited at the minimum protective distance, which more or less excludes the use of any existing signals, especially the block signals.

In addition, taking the hypothesis of a line run over by fast trains (120 km [80 miles] h. and over) and slow trains for example (45 to 60 km [27 to 37 miles]), the problem is as follows :

The distant signal protecting the level crossing should only be seen by the train when the warning device has already put the road signals to the « DANGER » position and freed the said distant signal. Doubtless these two operations will take place simultaneously as soon as the warning device is operated. But it seems to us that there is incompatibility between the warning period necessary for the road users and the need to site the railway signal at a suitable distance to protect the level crossing. Taking 1 200 to 1 500 m (3 936 to 4 920 ft.) as the distance required for protection and 10″ of visibility of the railway signal for the trains, or about 350 m (1 048 ft.) at 120 km/h, the minimum distance at which the warning device must be sited is about 1 600 to 1 900 m (5 250 to 6 240 ft.) from the level crossing, giving a 50″ to 60″ warning for the fastest trains, while in the case of the slow trains this period may extend to as much as 2 1/2 minutes or more. It does not appear that such figures are compatible with the need to give the « DANGER » signal to the road traffic for as short a time as possible so that motorists will not be tempted to cross against the lights.

On the whole, the protection of level crossings without keepers where automatic warning is given of the approach of trains by means of railway signals does not appear to us a practical solution except in exceptional cases, so that we do not think there can be any question of its generalization.

It would be interesting during the discussions to get the opinion of the Administrations using this device.

On the other hand, the idea of giving the trains a check on the proper working of the road signals, and giving it as early as possible at a distance which makes it possible for them to brake before reaching the crossing, seems to be of some value.

But here again is there not a risk of muddling the driver by the undue multiplication of the signals?

B. — Risks and difficulties occurring with level crossings without keepers equipped with automatic signals.

Failure of the warning. — Various breakdowns.

Risk of failure may affect the working of the actual warning device up to and including the relay. On the other hand, they may affect the working and operation of the signal. Making a comparison with a crossing with a keeper with warning of the approach of trains, the risks occurring in the first case are identical. Their con-

sequences are different however, as in the case of level crossings with keepers, the keeper at once sees that something has gone wrong and takes suitable steps (change over to the closed system). There is therefore no risk of accidents, in principle, except in the case of the first train after the failure, and here again if, as is done in some cases, the barriers of the level crossing are supposed to be shut five minutes before the time a regular train is due, there is only danger when the breakdown coincides with the passing of a special train.

In the case of a level crossing without a keeper, things are obviously quite different. But we have already seen when dealing with immediate warnings that precautions like doubling the contact devices, insulating the line, and the use of high quality relays, make the likelihood of a failure, thanks to periodical maintenance and inspection, extremely rare.

As regards the operation of the signal, the question arises of knowing whether the mechanical means used is more or less dependable than the human factor.

On the one hand it can be stated that a keeper can at once make good any failure, so that the risk does not continue (unless there is something seriously wrong with the keeper) whereas the failure of a mechanical device means that it has to be repaired, which cannot be done immediately.

The foregoing shows the need to use devices which, as far as is possible, show the road user the « DANGER » indication when anything goes wrong with them, although such an indication can only be given to a limited extent if anything is wrong with the signals themselves.

This limited « DANGER » indication may be given in various ways : Absence of the light indicating line clear when this is used by the railway — Automatic showing of the sign « DANGER » in the case of the Ervy-le-Châtel system — Automatic lowering of the half-gates or gates if there are any. When the road user sees such an indication he should redouble the care with which he crosses the line, as all he can depend upon is the actual visibility at close quarters, which means that this must be good. If there is a control signal on the line within braking distance of the crossing, the visibility at close quarters is extended.

Here again we see the need for educating and disciplining road users, and the standardization of the signals will considerably facilitate this.

Letting the railway staff know of the existence of a breakdown.

One method is to provide a control device at a neighbouring station (sign or bell), so that the station staff can see that the automatic signal is out of order. This solution has been adopted in Switzerland and Belgium.

We have seen that other Administrations have provided a control signal on the railway within braking distance of the crossing (Germany, Denmark [State], Aalborg Private Railway), and in this case the driver can report the breakdown.

The telephone stipulated by Spain to enable road users to ascertain what is happening can also be used to report a breakdown to the station. But this telephone itself may be out of order, as it is rarely used or inspected. Moreover it might be stolen.

In other countries, it seems that it is left to the road users to report anything wrong by the means they may choose as the best. Experience will show if that is sufficient.

Steps to be taken by the road users : 1) if anything goes wrong, and 2) if a road vehicle breaks down on the crossing.

If anything goes wrong, some Administrations stipulate that vehicles should stop and then proceed with care (Germany, Belgium (S.N.C.B.), S.N.C.F., Algeria, Franco-Ethiopian). Many others have not made any stipulations.

Belgium [S.N.C.B.] and the S.N.C.F. stress the need to have good visibility at the crossings. Most of the replies did not mention any precise regulations for crossing over the level crossing.

It appears not without interest to have such regulations inserted in the road codes.

If a vehicle should break down on the level crossing, no regulations have been proposed by any Administration. This is understandable as the road user must decide what it is best to do, and the Railway Administration is not competent to do so.

The S.N.C.F. stress however that to stop on the level crossing is an infringment of Railway Police Regulations and is illegal.

Spain stipulates that there should be a telephone but none have been installed. Belgium stresses that no such case has occurred since 1935.

CHAPTER V.

PRIVATE AND OTHER SUCH LEVEL CROSSINGS.

Private level crossings were built to enable the occupier of land to get access to parcels of land cut off by the building of the railway. In some cases, the owners of land have approached the railway after the line was built and asked for a private level crossing in order to facilitate access to or shorten the way to an adjacent parcel of land. Private level crossings only concern pedestrians or pedestrians and vehicles and herds and flocks.

On reading the replies received to questions 41, 42 and 43 it does not appear that this category of level crossing has caused the railway Administrations any undue trouble.

Question 41 asked in particular if the users of private level crossings had to obtain any authorisation from the railway Administration when they wished to use the level crossing for any abnormally heavy or long traffic.

Denmark (State) replied in the affirmative to this question. Abnormal traffic has to be notified to the station nearest the level crossing in order to fix the date and time. A regulation of the same kind, though less strict, is also in force in Sweden. The Franco-Ethiopian and Greek Railways also require authorisations to be obtained for any abnormal traffic.

The other railways do not seem to require any special precautions apart from care on the part of the users.

The question was also raised (questions 42 and 43) of installing telephones or warning bells at private level crossings. Telephones have not been installed by any Administration. Spain however considers that the installation of a telephone or other warning device by which communication could be established with an adjacent station or signal box would be of value. Very exceptionally bells have been installed in Belgium (should the warning fail, the railway is exonerated from any responsibility by contract with the user). It is also installed in exceptional cases in Denmark. In the same way, in Norway, but only exceptionally, automatic warning devices have sometimes been installed. Italy (State) has not so far installed any warning bells but thinks this might be of value in some cases. Finland also considers that the precaution is advisable, but does not state whether it has ever been taken.

The other Administrations have not done anything.

Finally question 44 asked if there were any other types of level crossings other than public and private crossings coming under headings A and B of the questionnaire. The replies received were negative apart from the following cases :

Belgium (S.N.C.B.) reports industrial crossings which are dealt with like level crossings without gates, the trains being protected by moveable or light signals on the road;

Finland mentions the case of road and rail using the same bridge;

The *Franco-Ethiopian* and *Morocco Railways* have special crossings for cattle;

Italy (State) has some crossings on mule tracks; these are equipped with special turnstiles and are treated like open level crossings without keepers;

Norway reports that there is not a very clear distinction between public and private crossings in some cases.

It is to be presumed that on the railways consulted there are some crossings at the ports where safety is assured in a simplified way, usually by the trains only moving at walking pace or with a guard at the head.

In conclusion, there do not seem to be any special difficulties as regards private level crossings. It appears however that the need to obtain an authorisation for abnormal traffic is a safeguard to be recommended when it can be imposed; it should however be noted that this relieves the user of responsibility to some extent.

The installation of a warning device : bell, if there is such an installation on the line or automatic warning, is to be recommended according to some Administrations in certain cases, but it can be appreciated that the railways have some hesitation about this in view of the question of responsibility to which it gives rise, unless, as in the case of Belgium, the user will absolve them from any responsibility.

It does not appear advisable to make any new private level crossings, and in such cases the railway Administrations should insist on conditions of visibility at least equal to those at level crossings without keepers. Finally, it appears essential that any regulations about keeping the gates closed and padlocked imposed on the users of private level crossings should be stringently adhered to.

CHAPTER VI.

TENDENCIES AMONGST THE ADMINISTRATIONS CONSULTED REGARDING THE USE OF THE ABOVE SOLUTIONS AND DECIDING THEIR FIELD OF APPLICATION.

Examination of the statistics.

If safety is the leading consideration in deciding which of the various solutions shall be adopted, the economic factor must also be carefully taken into account. Whether it is question of the operating of a railway line or any other activity in which human actions and mechanical equipment are concerned, there is always some risk of accident; the problem is to keep the risk within admissible limits. Just as no one would think of doubling or tripling the dimensions of a bridge that careful calculations and experience had shewn to be sufficient under the pretext of making quite sure it would not collapse, so the railway Administrations cannot over-equip their level crossings. It is an undoubted fact that it is particularly difficult to translate the probability of accidents occurring into any definite figure in the case of level crossings as we have already said, but difficulties of this sort occur in most cases.

In sum, the duty of the railways appears to be in the first place to do their utmost to safeguard safety with the financial resources available, making improvements according to the actual risks at each level crossing or category of level crossing. It is possible to go even further and hold that each time the railways make a saving in their way of operating a level crossing which can be devoted to some method of safeguarding human life from which greater results will be obtained, they are doing a useful job.

The perfecting of automatic signalling devices giving warning of the approach of trains which are likely to function satisfactorily from the safety point of view, as shown in the descriptive part of this report, has been studied and achieved by several Administrations, and raises the question of deciding whether the solution to the two following problems should not be sought for on these lines :

1) *Reduction of costs*, whilst maintaining an acceptable standard of safety and facilitating the passage of the road traffic, at a whole series of level crossings lying within the following limits :

— *lower limit :* above level crossings with little railway traffic, where the risk is small, the keeper has little to do, and might be done away with without automatic signalling, if the road traffic will not be inconvenienced.

— *upper limit :* to be determined with

prudence, and possibly extended as experience dictates.

2) *Improving the equipment at those level crossings which already have no keepers* and where no warning is given of the approach of trains, which are causing anxiety owing to the increase in the amount and speed of the road traffic, and where a simple limitation of the train speed and the speed of the road vehicles would be insufficient or incompatible with the working of the line or the road, it being understood that the cost of making such level crossings safer should not have to be borne by the railway.

Very clearly the solution is economic; it is also interesting from the general point of view, as it makes it possible to use some of the keepers for more productive work.

What degree of safety do the devices in use now give?

To answer this last question, we must pay particular attention to the opinions expressed by those Administrations, which already have some experience of automatic signalling equipment.

On the other hand, it would be interesting to consider the statistics of accidents at level crossings on a wide scale making it possible to compare the risks according to the system or equipment used. Unfortunately, it is not possible to give any complete statistics of this sort. Like the example attached to the questionnaire, the accidents for each system were given as a total, but many Administrations did not give both the number of level crossings worked on each system and the corresponding number of accidents, especially in the case of level crossings with keepers without warning devices, with telephone or manually-operated warning, with automatic warning.

Consequently it was not possible to give any percentage for each system. On the other hand, and here we are once again faced with the difficulties mentioned earlier in the report, even the percentages of accidents per system would not be of any great value for comparative purposes as this would entail dividing the gross percentages by a factor expressing the average risk proper to level crossings operated under each system. Investigations of this sort come up against insurmountable difficulties; even simplifying the problem to the utmost and remaining content with averages, the research work involved would be very complicated, and such simplification would minimize the value of the results obtained.

1. — *Statistics of accidents.*

In view of the difficulty of using the information collected, we have limited our statistics to the following tables :

1) Table showing the total accident figures for 1950 taken from the replies received from the following Administrations : S.N.C.B., Denmark (State), S. N. C. F., S. G. C. F. E., Gafsa, Morocco, Norway, Sweden, Portugal, Switzerland (C.F.F.), Luxemburg and Greece.

2) Recapitulative table showing their value per 100 level crossings and per year, for the statistical figures given in table 1, giving the number of victims per 100 accidents.

3) Tables showing the statistics of the S.N.C.B. and Swedish State Railways, statistics which are complete and include a certain number of level crossings equipped with automatic signalling.

4) Tables relating these figures for Belgium and Sweden to per 100 level crossings and per annum, and showing the number of victims involved in each 100 accidents.

We think that very great prudence is required in the interpretation of these figures. In the case of the complete statistics, we are not at all sure that comparable figures have been totalled up. In particular, it is not certain whether all the Administrations have included in the figures for accidents at level crossings with keepers incidents in which the gates have been run into without any serious consequences. We are inclined to think that if any indications

concerning the relative safety offered by the different systems are to be obtained, it would be better to begin with only to consider statistics covering a substantial number of level crossings working under the different systems and answering all the questions set (with the reservation, as we have already said of correcting them by means of the average coefficient of risk which unfortunately is not known), and comparing the conclusions to be drawn from the general statistics, as such conclusions can only be of a qualitative character.

From the statistics of the Swedish State Railways it appears :

1) that the percentage of accidents at level crossings with keepers is much greater than those at crossings without keepers. It is likely that collisions with the gates have been included in the Swedish statistics even if they had no serious consequences;
2) in the case of level crossings with keepers there are more accidents at level crossings with automatic warning devices than at level crossings where the warning is given manually, but the number of times the equipment goes wrong is very similar in both cases (0.92 for the level crossings with manual warnings and 1 for level crossings with automatic warnings) whilst the number of people involved in the accidents is approximately the same;
3) although there are many fewer accidents at level crossings without keepers, those that do occur are more serious. It appears that some reserve should be made as regards the more serious character of accidents at level crossings without keepers with automatic warning, as it is to be presumed that the average risk at such crossings is much greater than in the case of level crossings with keepers which cover a much wider scale of crossings. (Sweden indicates moreover that dangerous level crossings have generally been equipped with automatic signals);
4) statistics covering five years (1946 to 1950 inclusive) do not include a single accident due to the failure of the equipment in the case of level crossings with automatic road signals;
5) mistakes on the part of the road users account for a very high percentage (more than 96 %) for all categories of level crossings, both with and without keepers, but the consequences are much more serious in the case of level crossings without keepers as was only to be expected.

If these conclusions are compared with the results of the statistics for 1950 as a whole, it will be seen :

— that the first point is not proved; but as we have said, we feel that the figures giving the percentage of accidents at level crossings with keepers need taking with much reserve, whereas much weight should be attached to the opinion of certain Administrations, such as Sweden and Denmark, as regards level crossings with automatic signals, as the figures for this latter system are about the same as those for Sweden alone (3.8 compared with 3.62);
— the general statistics do not make it possible to come to any decisions as regards the second point;
— point 3 (more serious accidents at level crossings without keepers) is confirmed, but the difference is not so great as for Sweden alone, the general statistics showing 0.24 killed at level crossings with keepers, 0.40 at level crossings without keepers without automatic signals, and 1.6 at level crossings without keepers with signals, compared with figures of 0.12, 0.82 and 1.56 respectively for Sweden alone. It should be noted that the number of level crossings without keepers with automatic signals is about the same in both cases (1.6 compared with 1.56), which is not astonishing in view of the number of such crossings in Sweden. The same reservation as for the results for Sweden alone must be made here again as regards the serious character of accidents at level crossings without keepers with automatic signals;

— point 4 about defects in the equipment is proved;

— point 5 regarding the importance of mistakes on the part of road users is also proved, though there is a slight falling off in the percentage (between 84 and 100 % of accidents in the case of the general statistics compared with 96 to 100 % for Sweden).

For information about the numbers involved, it appears from the whole of the statistics received to date that the average number killed is 0.33 per year per 100 level crossings of all categories, and the average number of injured is 0.52 per year per 100 level crossings of all categories.

These statistics in addition show that the following were the average number of people killed in each country (1) :

Belgium (S.N.C.B.)	26	killed a year
France (S.N.C.F.+S.G.C.F.E.)	59	»
Holland	32	»
Portugal	10	»
Sweden	33	»
Switzerland (C.F.F.)	22	»

These figures relate to level crossings other than those solely for the use of pedestrians, which are used by the latter at their own risk and peril and do not much differ from the problem of crossing the road.

They make it possible to come to some conclusion regarding the true place level crossings hold amongst the great problems of protecting human lives. Undoubtedly, after a certain level of equipment, it costs more and more to prevent accidents. This is particularly true when we get to the point of replacing a level crossing by a subway or bridge. This explains why so much space has been devoted to the financial and economic aspect of the solutions for improving safety. The consideration of this aspect which may shock certain people is in fact essential if the research into the best use of the financial resources possible is to be carried out.

(1) Not including crossings for pedestrians only.

If the difficulties in the way of expressing the danger at level crossings gives little hope of tightening up the problem in so far as in each case the cost of improving the safety can be compared with the economies resulting from the falling off in the number of accidents, the above figures show however that accidents at level crossings, which have been the subject of several campaigns in the press, should not be overestimated as regards their relative importance. This also leads to the conclusion that as soon as the safety remains above a certain admissible level, operating economies are perfectly feasible, as the sums saved in this way can be used much more efficiently to protect human life in other spheres.

II. — *Opinions of the Administrations regarding the field of application of the system with no keeper with automatic warning of the approach of trains.*

Discipline of road users.

Amongst the Administrations with considerable experience of this system, Belgium (S.N.C.B.), Denmark (State and Aalborg Private Railway), Holland, Norway and Sweden consider that the ever increasing use of signals at road crossings is already educating road users to expect signals so that it is possible to extend the use of devices giving warning of the approach of trains at level crossings in the same way. Germany is less certain, and Switzerland (Federal Railways) considers that the two kinds of signals are not comparable, though not condemning the system for this reason. Amongst the other Administrations, the S.N.C.F., Overseas French Railways, Indochina, North of Milan Railway and Portugal also consider that the extended use of signals at crossroads is good for disciplining road users. Spain makes certain reservations in the case of agricultural regions and is worried about cattle. Italy (State) is very uncertain; it considers that its own experience has not given very favourable results, that automatic signalling is costly, and the discipline of road users an uncertain quality. Morocco, Tunisia and Algeria

have doubts about the discipline of the native population.

On the whole the majority of replies considered that the use of signals at cross-roads was likely to lead to good discipline amongst road users.

Spain merely makes a reservation in the case of cattle, a case we have already mentioned. The Swiss Federal Railways do not condemn automatic signalling for this reason. The attitude of the Italian State Railways can be further explained during the discussions.

Installations at level crossings with heavy road traffic. — Increasing the safety at level crossings where the barriers have already been removed and there are no signals.

Question 4 raised in particular the problem of installations at level crossings without keepers with no signals, and asked whether automatic signalling in the opinion of the Administrations consulted was simply a method of increasing the safety at such level crossings.

If we compare the replies given to this question with those given to question 5, which asked if on the contrary the same installations could be used in the case of level crossings with heavy road traffic without endangering safety, it appears that question 4 was not clearly understood by all the Administrations. In fact if the installation was considered suitable in the case of question 5, it will *a priori* improve the position at level crossings without keepers with no signals; we are more concerned with the replies to question 5.

Amongst the Administrations who have experience of automatic signalling, the following replied in the affirmative to question 5 :

Germany : who however considers it necessary to educate road users;

Belgium (S.N.C.B.) : who also considers it necessary to educate road users and stresses the fact that when the road traffic is heavy, it is extremely inconvenient if anything goes wrong with the equipment;

Denmark (State);

Holland;

Norway;

Sweden (State) : who also replied favourably, but was against such a practice on the national trunk roads.

On the other hand, the Aalborg Private Railway is of the contrary opinion and Switzerland (C.F.F.) does not agree to it in the case of important roads unless it is completed by automatic barriers.

The other Administrations expressed the following opinions :

In favour :

Spain : except in special cases where the road traffic is particularly heavy;

Finland : if there are not too many trains;

the *S.N.C.F. :* if the visibility at the crossing is good;

the *S.G.C.F.E. :* if road users are sufficiently educated;

Overseas France : up to a given traffic moment to be decided;

Italy (State) : with the reservation that there must be good discipline amongst road users and the installation must work well.

Against :

Algeria;

Gafsa Railway;

Morocco;

North of Milan Railway;

Luxemburg.

On the whole, a large majority of the Administrations, and in particular those Administrations with considerable experience of the system with no keepers and automatic signals — with some reservations in some cases — consider that this system can be applied to level crossings with heavy road traffic. It is to be inferred from this that not only do such installations make it possible to increase the safety at level crossings where the barriers have already been removed and there is no automatic signalling, but it also makes it possible to treat other level crossings with heavy road traffic working under a different system, and this raises the question of replacing

keepers by automatic signalling installations, the problem covered by question 6.

It should be noted however that in general the reservations made concern discipline amongst road users.

Substitution of automatic signalling for keepers.

Question 6 asked whether in the opinion of the Administrations consulted, the replacing of the usual system of keepers by the system without keepers with automatic signalling of the approach of trains was likely to reduce the number of accidents in some cases.

In the case of those Administrations having a good few automatic signalling installations, the replies received can be grouped as follows :

In favour :

Germany : with the reservation of educating the public;

Belgium (S.N.C.B.) : thinks that its experience in this connection has been favourable but considers that the road traffic must not be unduly heavy;

Denmark (State) and *Aalborg Private Railway :* except when there is a lot of shunting;

Norway;

Switzerland (C.F.F.) : if the road traffic is not too heavy;

Holland : are a little less sure and consider that there is merely a presumption that automatic signalling devices are an improvement.

On the other hand, Sweden considers that the risk of accidents will undoubtedly be increased owing to the lack of attention of road users in the case of level crossings over double track or multiple track lines. The Swedish reply once again shows the fear that there is a special risk in the case of double or multiple track lines.

The other Administrations gave the following replies :

In favour :

Spain : especially in the case of level crossings where it is difficult to have a keeper; no warning of trains, poor visibility, frequent delays to the trains;

the *S.N.C.F. :* with the reservation that road users must be well disciplined, owing to the rare failures with such equipment;

the *S.G.C.F.E. :* if road users are well disciplined;

Overseas France, Indochina, Italy (State) : if the working of the signals can be depended upon;

Luxemburg.

Against :

Finland : who is sceptical about the increased safety;

Algeria;

the *Gafsa Railway;*

Morocco : who thinks that a signal is less likely to be respected than a barrier which is more visible and a clearer warning to stop, yet even so frequently ignored;

the *Franco-Ethiopian :* who reports that it has however only one such level crossing;

No reply was received to this question from :

Portugal : who stated that they had no experience of the problem;

Greece;

Syria.

Here again the majority are in favour of substituting signalling for keepers, and all those Administrations who have had substantial experience of these devices are included in this majority, except for the Swedish objection in the case of level crossings over double or multiple track lines, and frequently with the reservation that road users must be well disciplined.

Details about the criteria upon which to base decisions to apply the system without keeper with signals.

The Administrations, who already have a substantial number of such devices in use, gave the following replies :

Germany : uses this system preferably in the case of single track lines in the case of level crossing where there are not many pedestrians (outside urban areas) and the motor traffic is heavy;

Belgium (S.N.C.B.) : in the case of level crossings whose traffic moment is below 10 000 unless there are more than 2 tracks, if there are

many children, and if the visibility at the crossing is poor;

Denmark (State) : gives no limits for the road traffic, but does not instal such equipment where the train speeds exceed 75 km (46 miles)/h;

the *Aalborg Private Railway :* did not reply;

Holland : gave 100 trains a day, 250 cars or vehicles, 5 to 600 motorcyclists, 5 to 600 pedestrians, but not many children. If there are more than 250 cars or trailer vehicles and up to 600. consider that the equipment supplemented by half barriers is still permissible. These figures can be modified according to local circumstances, such as the risk of traffic jams at peak hours. They add that it is difficult to set an exact boundary between the system without keeper without automatic signals and the system without keeper with automatic signals because local conditions and the visibility, and angle of crossing, and the road gradients are all factors which must be taken into account as being of greater importance in the case of level crossings without keepers without signals than in that of level crossings without keepers with signals;

Norway : did not reply;

Sweden : gave no exact regulations. They appear to use such equipment under fairly widespread conditions except near stations owing to shunting, level crossings over double or multiple track lines, level crossings with heavy road traffic and level crossings in towns or their suburbs.

The other Administrations expressed the following opinions :

Spain : states that although Spanish legislation has allowed of signals being substituted for keepers since 1934, this has never been done, but that it is proposed to do so progressively;

the *S.N.C.F. :* are only making provision at first to install such devices at level crossings where the traffic moment is not more than 3 000 in the case of signals with coloured lights, and 5 000 in the case where they are supplemented by half gates. Requires the level crossings to have good visibility at close quarters;

the *S.G.C.F.E. :* considers that the equipment is too costly to be used extensively on its lines;

Algeria : accepts if for special cases without giving any general rules;

Tunisia (Gafsa) : is considering it for level crossings near towns where the visibility is impeded by buildings;

Overseas France : gives no precise regulations. Is not considering multiplying such installations except for level crossings where the minimum traffic moment is 1 000 to 2 000;

the *Franco-Ethiopian Railway* is not considering using it;

Morocco : proposes to use it on certain roads with average traffic if the discipline of road users proves sufficiently good;

Indochina : is considering it;

Greece : is not considering its use;

Luxemburg : is studying it and considering a maximum traffic moment of 10 000;

Finland, *Italy (State)*, *North of Milan Railway*, *Portugal* and *Syria :* did not reply to the question.

This analysis shows that the criteria adopted by the different railways differ very considerably. Certain Administrations, who have considerable experience of the equipment such as Holland, are considering going as far as traffic moments of 25 000 without half gates, and much higher moments when half gates are used. The S.N.C.B., apart from cases with certain unfavourable factors, fixes the traffic moment at 10 000. Germany, without giving any figures considers such installations possible at level crossings with heavy motor traffic if there are not too many pedestrians. Luxemburg is also considering a traffic moment of 10 000. Sweden is not against such level crossings when the road traffic is heavy in the case of single track lines. The S.N.C.F. are rather under the previous figures with traffic moments of less than 3 000 if there are no half barriers and 5 000 with half barriers (for a beginning).

In fact it is not astonishing that there should be a certain timidity manifested by the Administrations, who have not yet had any extensive experience of these devices.

III. — *Conclusions.*

The use of the keeperless system with automatic signals in the case of level crossings whose importance lies within a certain scale is obviously looked upon with favour by a large number of Administrations. No doubt, they see therein the possibility of making economies and a more equitable division of responsibility between the rail-

way and road users, the former of whom has so far had to bear all the burden.

From the point of view of safety, many Administrations consider that this is in no way reduced. This point deserves explanation. An examination of the statistics, incomplete as they are, which are the essential basis of any information, proves without doubt that by showing the road user a « DANGER » signal giving warning of the approach of a train, the railways give him positive information and the risk that this is against safety is infinitesimal; the same examination shows that this risk is less than that of the barriers not being closed in the case of level crossings with keepers (1). We are therefore led to conclude that from the technical point of view the system without keeper with warning of the approach of trains is safer than the system with keepers however perfected this may be (taking into account as we have seen the difficulties attached to covering the crossing by interlocked signals in both cases).

Here we come up against a psychological factor. Obviously, the closed barriers of a level crossing are not only a signal but also an obstacle, and these are obeyed by all drivers who are in control of their reflexes and their vehicle. If it is merely a case of bad driving or tardy vigilance, the effects of the accident are not very serious. A light signal obviously is quite another matter.

This explains on the one hand the almost unanimous insistence of the Administrations upon the importance of discipline amongst road users and on the other hand, the statistical results concerning the seriousness of accidents at level crossings without keepers with automatical signals (as moreover at all level crossings without keepers in general).

Is this going to be an insurmountable obstacle to the adoption of the keeperless system with automatic signals? This system can already be made very similar to the system with keepers from the point of view with which we are now concerned by the use of half barriers, and still more so by the use of automatic barriers. But automatic barriers give rise to other serious problems in view of prolonged failures. Should the use of half barriers be made the general practice?

It appears that the reasonable solution may be to add to the equipment and use half barriers or if necessary barriers after a certain degree of importance is reached or when the road traffic has certain characteristics. In addition, the first thing to be done is to improve the discipline amongst road users by a vigorous press campaign and by fines if need be.

A final argument in favour of the keeperless system with automatic signals is that such a system is a great deal more favourable to the free flow of the road traffic than the system with keepers, as the light shows instantaneously, so that the warning distance can be considerably reduced.

CHAPTER VII.

GENERAL SUMMARIES FOR QUESTION I-A.

1. — In endeavouring to improve the safety at level crossings financial considerations are of very great importance, as this problem is only one special case of the general problem of safeguarding human life, and the general interest requires that the funds available be spent on the solutions that show the greatest returns in this connection.

This consideration justifies the efforts made by the railway Administrations not only to improve the equipment, but also to reduce the cost of operating their level crossings.

(1) Information received from the S.N.C.F. after its reply had been sent in indicated that with 9 400 level crossings concerned there were 18 mistakes on the part of the keeper in 1950 and 21 in 1951 (i. e. 0.21 per 100 level crossings per annum), 5 of which are absolutely inexplicable (i. e. average of 0.027 per 100 level crossings per annum) whereas the failure of the warning to operate was only on the scale of 0.011 per 100 level crossings per annum for these same level crossings. This seems to show that the intervention of the human factor increases the danger inherent in the use of an automatic warning device.

2. — The railway Administrations are convinced of the necessity of making the safety conditions at level crossings compatible with the changed position due to the increase in the speed, number and tonnage of modern road traffic.

In view of the great diversity in the positions of level crossings, it is essential, in order to assure the optimum use of the financial resources devoted to these improvements, to graduate the scale of equipment used at level crossings according to their importance and the risks involved.

3. — In general the various Administrations have made it much easier for road users to see that they are approaching a level crossing by putting up the signs laid down by the Geneva Protocol on the motor roads.

The visibility of these signs at night has been improved by catseyes or luminous paint.

In view of the probable development of automatic warning signals at level crossings without keepers, there seems to be some advantage in letting road users know by the distant signals used in the case of level crossings without keepers, if the level crossing they are approaching is equipped with automatic signalling or not. This suggestion might be laid before the International Commissions responsible for drafting road signalling codes.

4. — The equipment of level crossings with keepers has been the subject of many improvements introduced by the railway Administrations according to their financial resources. It does not seem right that the cost of such equipment should be borne by the railway alone.

The main improvements perfected by the railways are the following :

The visibility of the barriers when closed has been improved by day by appropriate paintwork; red on a white or light yellow ground. The visibility at night has also been increased by means of reflectors : catseyes, luminous paint.

The installation of swing lifting barriers which can be raised quickly and easily has been extended. This type of barrier greatly increases the safety by shortening the time taken to shut the barriers and reducing the serious consequences of running into them.

The methods by which the keeper is advised of the arrival of trains have been greatly improved and extended. Apart from the many manual warnings given by telephone, certain Administrations have perfected and extended the use of automatic warnings; they have introduced devices which very rarely break down. The technical services of the various Railways have been able to find solutions to the problems arising in the case of automatic warnings, not only in a general fashion, but also in particularly difficult cases, such as when a station lies within the warning distance.

Protecting level crossings by signals which are interlocked or otherwise is generally considered to be a further addition to the safety, but these have certain drawbacks as regards the flow of the road traffic and the regularity of the trains so that they cannot be generally used, and have often been banned at level crossings with heavy road and rail traffic.

5. — The regulations governing the conditions to be fulfilled if the keeperless system without warning of the approach of trains is to be used are not uniform, but the considerations on which they are based do not lead to much difference of opinions. The special risk presented by the passing of flocks and herds over crossings of this kind are mentioned by several Administrations, and it seems essential that the codes regulating road traffic should detail the precautions to be taken with such traffic and be rigorously enforced.

6. — There are now available very reliable devices which enable a signal to be given to road users approaching level crossings without keepers warning them of the approach of trains. It can be affirmed that these automatic signals are just as safe and reliable as the closing of the barriers by the keeper at a level crossing. But there remains a great deal to be done to obtain good discipline on the part of

the road users, as the « DANGER » signal unlike the barrier is not a physical obstacle preventing the level crossing being used. For this reason, unless discipline is improved there will always be a risk of accidents at level crossings without keepers with automatic signals, accidents which though few in number are likely to be more serious.

It may be thought that the addition of automatic half barriers is likely to reduce the risk of road users disobeying the signals as mentioned above, according to whether they are confronted with closed barriers or merely a red light.

The remark in paragraph 5 about cattle using the crossing also applies to the system without keepers with automatic signals. Certain Administrations report in addition that there are special risks in certain cases where the level crossing is used by a large number of schoolchildren. Although pedestrians cross at their own risk and peril whatever system is in use, it is recommended to train schoolchildren by press campaigns and other methods.

There is no absolute unanimity amongst the Administrations on the programme to be fulfilled by the automatic signalling installation, especially as regards the « line clear » signal. It would be very desirable to get agreement to make it easier for foreigners to obey the rules.

In addition it is desirable, with the same object, that the exact meaning of the red light, which in our opinion can only meant a permissive stop, should be made quite clear in the highway code, and on the other hand the same code should clearly lay down the behaviour of road users when anything goes wrong with the automatic signals (approach the level crossing with due care and look in both directions, which means that the visibility up and down the line must be good).

In view of the special problem caused by double track lines since a train may come from the opposite direction just after one train has cleared the crossing, it is recommended that a double St. Andrew's Cross should always be used at level crosssing without barriers over double track lines.

7. — Substituting the keeperless system for keepers is a source of economies. In addition, it is of general interest at it makes it possible to transfer this labour to other more productive fields. Finally to many Administrations it appears to give a more equitable division of the responsibility as between the railway and the road. The latter preoccupation is all the more acute since the traffic involved in the two cases has been considerably modified (railcars compared with large capacity lorries), so that the possible consequences of accidents at level crossings are now much more serious for the railway owing to the character of some road traffic (bulk fuel transport).

There are numerous cases where the characteristics of the level crossing : amount and kind of the road traffic, amount of railway traffic, visibility, make it possible to get sufficient safety with the keeperless system without signals. Regulations concerning the visibility near level crossings will facilitate the extension of this system and increase the safety.

The question of deciding whether it is possible to contemplate substituting the keeperless system with automatic signals giving warning of the approach of trains on a large scale should be examined very carefully. It does not appear possible at the present time to fix the exact limits within which this can be done, as these limits vary very considerably according to the education and discipline of the road users; in countries where such automatic signalling is not yet very widespread, it appears recommendable to fix these limits with prudence and be prepared to raise them progressively. It appears moreover that the addition of automatic half barriers makes it possible to raise these limits. The addition of automatic barriers may appear still more satisfactory from this point of view, but these raise serious problems if anything goes wrong. Barriers also involve the question of the distant road signal.

8. — The installation of automatic signals giving warning of the approach of trains seems to be a solution to be recommended

in order to improve the safety at level crossings without keepers without signals when an increase in the amount and speed of the road traffic makes the existing system of doubtful safety, and it is not possible to solve the problem by other means such as reducing the train speeds, increasing the visibility by such work as cutting back the approaches, and enforcing definite regulations concerning maintaining the visibility unimpaired at level crossings.

It is only just that the cost of improving the safety in this way should not be borne by the railway alone.

9. — Private level crossings do not appear to cause the different railway Administrations any serious trouble.

It does not appear desirable to increase their number however. If any new crossings of this type type are made, it appears essential to stipulate that the visibility shall comply with that laid down for level crossings without keepers.

Where there is likely to be any special bulk traffic that can block the crossing, it is to be recommended that this shall previously be notified to the railway Administration.

Finally, it is essential that good discipline be demanded of the users of private level crossings as regards their obligations to keep such crossings closed and padlocked and notices showing the character of such crossings must be used.

10. — It is very desirable that the railway Administrations should come to an agreement amongst themselves regarding the way statistics of accidents are made, so that these are identical and capable of providing numerical data for each kind of level crossing covering a very large number of cases.

PART II.

QUESTION I-B.

Level crossings at which an urban or suburban railway line also crosses the railway alongside the road.

The problem is different according to whether the urban or suburban trains do not always run at sight and consequently have to be given an indication at a distance when they must stop and when on the contrary they always run at sight (with if necessary a certain priority over road vehicles), like tramways.

In the first case, even if the small railway uses the road, such a crossing must be treated like any railway crossing, i.e. with interlocked signals for all directions at the crossing.

In the second case, the level crossing is treated like an ordinary level crossing, with if necessary a permanent speed restriction on the tramway if this has been found necessary to facilitate running at sight near the level crossing.

The question was asked (question 41) what arrangements were made in the case of level crossings without keepers with automatic signalling where an urban or suburban line followed the road. In particular, it was asked whether speed restrictions were imposed on the small railway, if special automatic signalling with a longer warning period than that addressed to road vehicles was provided, and if any automatic derailing devices were used to protect the railway lines.

None of the Administrations consulted reported any cases of level crossings without keepers with automatic signalling used by an urban or suburban line running alongside the road.

TABLE I.

The following statistical table summarises the remarks made by the following countries :

Belgian National Railways, Danish Railways, S.N.C.F., Société Générale des Chemins de fer Economiques (France), Gafsa Railway, Morocco Railway, Greek Railways, Luxemburg Railways, Norvegian Railways, Portuguese Railways, Swedish Railways, Swiss Federal Railways for 1950.

Installations with automatic gates are too few in number for the statistics relating to them to be considered of much value.

CATEGORIES OF LEVEL CROSSINGS	Number of level crossings to which the figures relate	Total number of accidents	Number of accidents				Number of persons concerned		Causes of accidents				
			Pedestrians and cyclists	Motors	Horse drawn vehicles	Cattle	Killed	Injured	Mistakes on the part of railway employees	Failure of equipment	Mistakes on the part of road users: Running through the barriers	Mistakes on the part of road users: Various	Various causes
Side gates for pedestrians	2 676	10	8			2	7	3				9	1
Level crossings with barriers and keepers :													
a) without warning devices	34 422	114	8	98	7	1	8	8	16		85	4	9
b) with warnings given manually or by telephone		554	28	498	22	6	25	81	46	4	451	34	19
c) with automatic warning.		144	1	135	3	5	(1) 51	44	19	3	113	9	
	Totals	812	37	731	32	12	84	133	81	7	649	47	28
Level crossings without gates without automatic signals.	23 969	299	57	186	32	24	99	135	2		73	179	45
With automatic signals. . .	1 659	62	13	47	2	0	27	41			60	2	

(1) 25 were killed in one accident at St. Amour (France).

TABLE II.

Table giving the global statistics in percentage for 1950.

KIND OF LEVEL CROSSING	No. of accidents per 100 level crossings per annum	Number of persons killed per annum		No. of persons involved per annum per 100 level crossings	Attribution of causes of accidents			
		per 100 level crossings	per 100 accidents		Mistakes on the part of employees	Defects of equipment	Mistakes on the part of road users	Various
Small gates for pedestrians	0.37	0.26	70	0.37	—	—	90 %	10 %
Level crossings with barriers with keepers.	2.36	0.24	10.34	0.63	9.97	0.86	85.7 %	3.46 %
Level crossings without barriers :								
a) without automatic signals	1.2	0.4	33	0.9	0.7	—	84 %	15 %
b) with automatic signals.	3.8	1.6	44	4.2	—	—	100 %	—

TABLE III.

S. N. C. B.

Statistics of level crossing accidents for the years 1946 to 1950.

CATEGORY OF LEVEL CROSSING	Number of level crossings	Number of accidents	Number of accidents				Number of persons involved		Causes of accidents				
			Pedestrians and cyclists	Motorcars	Horse-drawn vehicles	Cattle	Killed	Injured	Mistakes on the part of employees	Breakdowns of equipment (warning and signals)	Mistakes on the part of road users: Running into the barriers or not observing the signal	Mistakes on the part of road users: Various	Other causes
	1	2	3	4	5	6	7	8	9	10	11	12	13
Small gates for pedestrians :													
1946	800		6				5	2				6	
1947	800		8				5	3				8	
1948	800		6				3	3				6	
1949	800		5				3	3				5	
1950	800	—	—	—	—	—	5	2			—	7	
Total	4 000		32				21	13				32	
Level crossings with barriers and keepers :													
without warning devices with manual warning or telephone													
1946	2 215	9		7	2		1	10	4		2	3	
1947	2 204	21	—	17	4		6	30	7		7	5	2
1948	2 199	16	2	11	2	1	15	16	5		6	4	1
1949	2 184	10		8	2		6	3	6		2	2	
1950	2 150	15	—	10	2		2	25	6	1	4	4	—

1948 . . .													
1949 . . .	7												
1950 . . .	7												
Level crossings with automatic barriers :	None												
Level crossings without barriers :													
without automatic signalling :													
ordinary 1946 . . .	1 850	42	11	17	14		12	22				42	
1947 . . .	1 832	32	9	11	12	—	13	6	—	—	—	32	
1948 . . .	1 826	42	12	23	7		16	26				42	
1949 . . .	1 797	42	13	24	5		13	29				42	
1950 . . .	1 776	42	9	30	3		13	30			—	42	
Total . . .	9 081						67	113				200	
with S.F. 5 K. signals :													
1946 . . .	219	15	1	13	1	—	—	4				15	
1947 . . .	225	9	1	7	1			1			-	9	
1948 . . .	225	11	2	7	2			6				11	
1949 . . .	231	4	1	2		1	—	4				3	1
1950 . . .	238	9	1	7	1	—	—	9	—	—	—	9	
Total . . .	1 138	48						24				47	1
with automatic signalling :													
1946 . . .	290	6	3	3			7	4	—	—	6		
1947 . . .	294	13	8	3	2	-	8	5	—	—	13	—	
1948 . . .	299	15	6	6	3	-	4	4	—	—	15	—	
1949 . . .	320	23	10	10	3	-	13	9			23		
1950 . . .	348	18	5	13		—	5	20	—	—	18	—	
Total . . .	1 551	75					37	42			75		
Private level crossings :													
1946 . . .	1 100		—	1	—		1	—	—		—	1	
1947 . . .													
1948 . . .	1 105		1	1	—	—	1	—	—	—		2	
1949 . . .	1 105		2	2	—	—	1	1		—	—	4	
1950 . . .	1 102		2	2	—	—	2	—	—	—	—	4	
Total . . .	4 412												

(1) It appears that these statistics do not include collisions with the barriers.

TABLE III.

SWEDISH STATE RAILWAYS

Statistics of accidents at level crossings.

YEAR 1946.

CATEGORY OF LEVEL CROSSING	Number of level crossings	Number of accidents	Number of accidents: Pedestrians and cyclists	Number of accidents: Motorcars	Number of accidents: Horse drawn vehicles	Number of accidents: Cattle	No. of persons involved: Killed	No. of persons involved: Injured	Causes of accidents: Mistakes on the part of employees	Causes of accidents: Breakdowns of equipment (warning and signals)	Causes of accidents: Mistakes on the part of road users: Barriers run into or signals not observed	Causes of accidents: Mistakes on the part of road users: Various	Causes of accidents: Various causes
	1	2	3	4	5	6	7	8	9	10	11	12	13
Small gates for pedestrians :	15	—	—	—	—	—	—	—	—	—	—	—	—
Level crossings with barriers and keepers													
without warning devices .	—	—	—	—	—	—	—	—	—	—	—	—	—
with manual or telephone warning	1 841	204	—	187	17	—	1	18	3	1	200	—	0
with automatic warning . .	474	98	4	84	10	—	2	6	3	2	90	3	0
Level crossings with automatic barriers	1	0	—	—	—	—	—	—	—	—	—	—	—
Level crossings without barriers :													
without automatic signals .	1 564	23	2	16	5	—	9	8	—	—	—	23	—
with automatic signals. . . .	738	31	3	26	2	—	17	22	—	—	30	1	—

SWEDISH STATE RAILWAYS

Statistics of accidents at level crossings.

YEAR 1947

CATEGORY OF LEVEL CROSSING	Number of level crossings	Number of accidents	Number of accidents: Pedestrians and cyclists	Number of accidents: Motorcars	Number of accidents: Horse drawn vehicles	Number of accidents: Cattle	No. of persons involved: Killed	No. of persons involved: Injured	Causes of accidents: Mistakes on the part of employees	Causes of accidents: Breakdowns of equipment (warning and signals)	Causes of accidents: Mistakes on the part of road users: Barriers run into or signals not observed	Causes of accidents: Mistakes on the part of road users: Various	Causes of accidents: Various causes
	1	2	3	4	5	6	7	8	9	10	11	12	13
Small gates for pedestrians :	13	—	—	—	—	—	—	—	—	—	—	—	—
Level crossings with barriers and keepers :													
without warning devices. . .	—	—	—	—	—	—	—	—	—	—	—	—	—
with manual or telephone warning	1 866	208	6	192	9	1	6	10	2	2	196	6	2
with automatic warning. . .	489	105	—	94	11	—	—	3	5	—	95	5	—
Level crossings with automatic barriers	1	1	—	1	—	—	—	—	—	—	1	—	—
Level crossings without barriers :													
without automatic signals. .	—	—	—	—	—	—	—	—	—	—	—	—	—
with automatic signals. . . .	766	22	4	16	1	1	9	9	—	—	18	2	2

SWEDISH STATE RAILWAYS

Statistics of accidents at level crossings.

YEAR 1948.

CATEGORY OF LEVEL CROSSING	Number of level crossings	Number of accidents	Number of accidents: Pedestrians and cyclists	Number of accidents: Motorcars	Number of accidents: Horse drawn vehicles	Number of accidents: Cattle	No. of persons involved: Killed	No. of persons involved: Injured	Causes of accidents: Mistakes on the part of employees	Causes of accidents: Breakdowns of equipment (warning and signals)	Causes of accidents: Mistakes on the part of road users: Barriers run into or signals not observed	Causes of accidents: Mistakes on the part of road users: Various	Causes of accidents: Various causes
	1	2	3	4	5	6	7	8	9	10	11	12	13
Small gates for pedestrians	17		1		—	—	1	—	—	—	—	1	—
Level crossings with barriers and keepers													
without warning devices . .	—	—	—	—	—							—	—
with manual or telephone warning	2 246	229	3	215	10	1	3	10	5	2	217	5	0
with automatic warning. . .	596	98	5	89	4			1	1	1	90	6	
Level crossings with automatic barriers	1	0	—	—	—	—	—	—	—	—	—	—	—
Level crossings without barriers													
without automatic signals. .	1 902	40	4	31	5		8	20			—	40	—
with automatic signals . . .	913	34	9	24	—	1	20	28			33	1	

SWEDISCH STATE RAILWAYS

Statistics of accidents at level crossings.

YEAR 1949.

CATEGORY OF LEVEL CROSSING	Number of level crossings	Number of accidents	Number of accidents: Pedestrians and cyclists	Number of accidents: Motorcars	Number of accidents: Horse drawn vehicles	Number of accidents: Cattle	No. of persons involved: Killed	No. of persons involved: Injured	Causes of accidents: Mistakes on the part of employees	Causes of accidents: Breakdowns of equipment (warning and signals)	Causes of accidents: Mistakes on the part of road users: Barriers run into or signals not observed	Causes of accidents: Mistakes on the part of road users: Various	Causes of accidents: Various causes
	1	2	3	4	5	6	7	8	9	10	11	12	13
Small gates for pedestrians :....	16	—	1	—	—	—	1	—	—	—	—	1	—
Level crossings with barriers and keepers :													
without warning devices. . .	—	—	—	—	—	—	—	—	—	—	—	—	—
with manual or telephone warning	2 300	244	6	231	6	1	1	10	6	3	229	6	—
with automatic warning. . .	612	98	3	92	3	—	1	2	2	—	94	2	—
Level crossings with automatic barriers	1	0	—	—	—	—	—	—	—	—	—	—	—
Level crossings without barriers :													
without automatic signals. .	1 856	66	7	56	3	—	24	37	—	—	—	66	0
with automatic signals. . . .	961	43	3	36	3	1	7	16	—	—	37	5	1

SWEDISCH STATE RAILWAYS

Statistics of accidents at level crossings.

YEAR 1950.

CATEGORY OF LEVEL CROSSING	Number of level crossings	Number of accidents	Number of accidents: Pedestrians and cyclists	Number of accidents: Motorcars	Number of accidents: Horse drawn vehicles	Number of accidents: Cattle	No. of persons involved: Killed	No. of persons involved: Injured	Causes of accidents: Mistakes on the part of employees	Causes of accidents: Breakdowns of equipment (warning and signals)	Causes of accidents: Mistakes on the part of road users: Barriers run into or signals not observed	Causes of accidents: Mistakes on the part of road users: Various	Causes of accidents: Various causes
	1	2	3	4	5	6	7	8	9	10	11	12	13
Small gates for pedestrians : . .	20	—	1	—	—	—	1	—	—	—	—	—	—
Level crossings with barriers and keepers :													
without warning devices . .	—	—	—	—	—	—	—	—	—	—	—	—	—
with manual or telephone warning	2 324	313	3	301	9	—	2	14	6	3	293	11	0
with automatic warning. . .	661	101	—	98	3	—	—	5	—	2	97	2	0
Level crossings with automatic barriers	1	0	—	—	—	—	—	—	—	—	—	—	—
Level crossings without barriers :													
without automatic signals. .	1 958	57	7	50	—	—	19	37	—	—	—	57	—
with automatic signals. . . .	1 041	28	7	19	2	—	16	8	—	—	26	2	0

TABLE IV.

SWEDISH STATE RAILWAYS

Statistical table giving percentages for 1946 to 1950.

SWEDEN.

KIND OF LEVEL CROSSING	Number of accidents per annum per 100 level crossings	Number killed		No. of persons involved per annum per 100 level crossings	Attribution of the causes of accidents			
		per 100 level crossings per annum	per 100 accidents		Mistakes on the part of employees	Defects of equipment	Mistakes on the part of road users	Various
Level crossings with barriers and keepers :								
a) with manual or telephone warning .	10.38	0.12	1.08	0.71	1.84	0.92 %	96.15 %	1.09 %
b) with automatic warning	17.65	0.11	0.60	0.71	2.2	1 %	96 %	0.8 %
Level crossings with automatic barriers.	0.2	—	—	—	—	—	100 %	—
Level crossings without barriers :								
a) without automatic signals	2.55	0.82	32.25	2.22	—	—	100 %	—
b) with automatic signals	3.62	1.56	43.12	3.43	—	—	96.87 %	3.13 %

TABLE IV.

S. N. C. B.

Statistical table giving percentages for 1946 to 1950.

BELGIUM.

KIND OF LEVEL CROSSING	Number of accidents per annum per 100 level crossings	Number killed		No. of persons involved per annum per 100 level crossings	Attribution of the causes of accidents			
		per 100 level crossings per annum	per 100 accidents		Mistakes on the part of employees	Defects of equipment	Mistakes on the part of road users	Various
Small gates for pedestrians	0.80	0.52	65.65	0.85	—	—	100 %	—
Level crossings with barriers and keepers with manual or telephone warning ...	0.65 (1)	0.27	42.25	1.04	38 %	1.6 %	55 %	4.4 %
Level crossings without barriers								
a) without automatic signals :								
1. ordinary	2.20	0.74	33.5	1.98	—	—	100 %	—
2. with SF 5 K signals.	4.22			2.11	—	—	97.9 %	2.1 %
b) with automatic signals	4.84	2.38	49.33	5.09	—	—	100 %	—

(1) It appears that these statistics do not include collisions with the barriers.

[656 .225 & 656 .261]

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

ENLARGED MEETING OF THE PERMANENT COMMISSION
(STOCKHOLM, 1952.)

QUESTION II.

What are the quickest and most economical means to carry out door to door service for railway transports?

What are the best conditions of use of containers for small miscellaneous traffic (dimensions of the containers, conditions of ownership, tariffs)?

What are the packing types to be recommended?

REPORT

(Austria, Belgium and Colonies, Bulgaria, Czechoslovakia, Denmark, France and French Union, Finland, Western Germany, Greece, Hungary, Italy, Luxemburg, Netherlands, Norway, Poland, Portugal and Colonies, Rumania, Syria, Spain, Sweden, Switzerland, Turkey, Yugoslavia),

by F. SAUVAGEAT,

Adjoint au Chef de l'Exploitation du 1er Arrondissement des Chemins de fer fédéraux suisses.

FIRST PART.

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FOREWORD.

The first part of the question covered by the present report has certain points in common with Question VIII which was examined by the Rome Congress in 1950. Amongst other things it was then asked what were the *most suitable methods*, apart from reduced tarifs, for retaining the full load traffic on the railway. The problem we are considering in Chapter I : « Full loads without transhipment » is identical from the technical point of view with that examined at the Rome Congress. There has not been any evolution since then which would result in different conclusions from those of 1950 in so far as the technique of the terminal transport of full loads is concerned. We think however it is of value to recall in the present report the present day technique and recent innovations which the railways reported in their replies.

Being anxious not to go outside the limits set as regards the general problem of the most rapid and economic methods of assuring door to door services, we have taken great care to collect together all the factors likely to facilitate the ascertaining of the comparative cost of the equipment and gear most widely used and likely to make the terminal services more efficient.

Unfortunately, we had not enough time to complete the comparative tables appended to the report as much as we should have wished. Moreover, certain recently introduced methods have not yet been sufficiently tested to enable the Administrations concerned to give sufficiently complete details. Thus the results obtained to date by the greater use of pallets does not yet enable a complete picture of the possibilities of this new technique to be given, as in the countries where they are already used, pallets are only used to a limited extent or not at all between stations and client's premises, i. e. in spite of their role as a carrier, they are only used for door to door traffic very exceptionally.

We considered it advisable to divide our report into two main parts, namely :

— door to door services, in which we have included details of the conditions under which containers are used for small consignments traffic;

packings.

INTRODUCTION.

A detailed questionnaire for Question II, drawn up in collaboration with M. F. GERST, formerly Chief Assistant Manager of the Commercial Department of the Netherlands Railways, was sent to 78 Administrations in European Countries and their Colonies, with the exception of Great Britain and the Soviet Union. Forty-two Administrations replied. From many of the replies it appears that all the railways are endeavouring, though to a varying extent, to make their door to door services more efficient, and consequently more economic. They also express their interest in stan-

dardization and the improvement of packings, especially as the handling of goods by means of the new carrying devices, the pallets U. I. C. type standardized now starting to be developed in several countries.

We wish to express our thanks to the Administrations, who were good enough to reply in a detailed fashion to our questionnaire, and thus facilitated the preparation of the present report. The Reporter would also like to thank M. W. Barblan, Economist attached to the General Management of the Swiss Federal Railways, who took a great part in the analysis of the replies and the preparation of this report.

* * *

FIRST PART.

DOOR TO DOOR SERVICES.

I. Full loads without transhipment.

A. — *Taking the wagon to clients's premises.*

1) *Private sidings.*

The private siding which is in fact an extension of the railway into the client's premises, and which, when the amount of traffic justifies it, can be equipped with all the technical improvements needed for the shunting of the wagons and their systematic loading and unloading, is today still the most officient, if not the most economic, method of assuring door to door transport, whether it is question of full loads or small consigments carried on a fairly heavy scale. Consequently, with only about one exception, the Administrations consider that from the commercial point of view, it is advantageous to develop private sidings to the greatest possible extent, especially as they save the railway the relatively high cost of maintaining and often of extending other sidings. A further even more important factor is that the direct service to industrial premises makes it possible to avoid the terminal costs involved in transshipment at the station and consequently makes this traffic less vulnerable to competition.

In France, the S. N. C. F., according to its specifications, cannot grant any subsidies to facilitate the construction of private sidings apart from capital loans granted to link them up with its own lines (beginning of the siding).

This railway encourages the development of such sidings by various methods such as giving them old materials, which are still in a usable condition.

The special tariffs granted by allowing fairly rapid amortization of the capital invested, are in addition sufficiently attractive to encourage the building of such sidings.

The Algerian Railways for some time have agreed to forgo all siding dues. In addition they have reduced the minimum taxation distance from 25 to 10 km and in the case of distances of less than 50 km replaced the fixed charge F per ton by a charge of F/50 per ton per km. Finally, they base their service charges on a very low rate.

The Overseas French Railways are also devoting the greatest attention to the development of private sidings. They favour the building of these by taking over part of the cost of construction, for example by selling or hiring used track equipment at a very cheap price and taking over the cost of *construction of the line on which such sidings are sited,* as systematically provided in the town plans.

Belgium facilitates the development of private sidings by :

— drawing up the plans free of charge;

— supplying material and labour at the lowest cost;

— hiring out material.

In Holland, the private sidings in principle are charged with the cost of installation and maintenance of the track. But if the client in question is not able to invest the necessary large amount of capital, the railway comes to his aid and if necessary

shares in the cost of installation on condition that it can expect to derive considerable advantages therefrom and when it is possible to make an agreement assuring that the traffic will be sent by rail over a long period.

The Netherlands Railways do not grant any special rates. However, they make special agreements with the client which repay him the whole or part of the cost of hire or maintenance when he receives or consigns a certain number of wagons per annum.

In Italy, the State Railways have always considered private sidings as an excellent way of getting new traffic. For a long time, they have granted the following facilities in connection with such sidings

supplying the material to lay the line for the siding provided this is paid for within 9 years;

- electrification at the railways' expense of that part of the siding coming within the station boundaries;

reducing to the minimum the cost of sending and collecting wagons at the point where the siding links up with the railway. In the case of new sidings, this amount has even been reduced by 50 % for the first five years;

- granting a refund of 10 % of the total amount as above paid during the year for existing sidings which have shown an increase in traffic of more than 10 % compared with 1949.

In addition, Italy is now studying the question of granting the owners of private sidings even greater facilities. Reductions in the transport rates are not under consideration however.

Austria recommends that the owners of private sidings should receive preferential treatment from the railway in view of the value as regards the quick turnround of the wagons generally obtained with such installations, owing to the short time taken to load and unload.

In Germany, Turkey and Czechoslovakia, the railways also facilitates the construction of private sidings. But no indication was given as to how this is done.

In Finland, the railway administration grants reductions in the cost of transport in the case of gravel and other necessary materials; the acquisition of rails, sleepers, etc. is also facilitated.

In Greece (Hell.), private sidings are constructed at the expense of the railway.

In Morocco, such installations are also being developed. But any expenditure in which the railway is involved as regards the construction and maintenance is covered by the owners.

In Mozambique, the railway builds the sidings and the owners pay an annuity of 6 % of the cost of the material for the track; this annuity includes the maintenance costs.

In Norway, as in Luxemburg, Portugal, and Thessaly (Greece), the railway in addition to granting special rates, shares in the cost of installation.

In Sweden, on the other hand, it is not considered advisable to encourage private sidings, as this involves more costly marshalling of the wagons without being effective against competition from lorries.

Finally, in Switzerland, the railway shares in the cost of making private sidings, up to 50 % of the cost if the owner of the siding agrees to contract to send all his traffic beyond a certain radius by rail. The construction of the feeder lines to the siding is particularly facilitated. On the other hand, the railway administration considers that it is not fair to grant special rates to the users of private sidings and not to other clients who are not able to build such sidings on account of geographical condition, production and consumption conditions, etc. In addition, the user of a private siding already benefits by great advantages as regards economies in the cost of haulage and lower charges for demurrage than on the railway siding lines.

During a recent investigation carried out by the Swiss Federal Railways, it appeared that the fact that the railway would bear up to 50 % of the capital costs as is the practice to date when the client in question signs a fidelity contract with the railway, was not sufficient in each case to decide a client who wished to be connected up with the railway by means of such a siding to shoulder the responsibility for the other 50 % of the cost, which often amounts to a considerable sum. It has therefore been agreed that when the siding is of real value from the commercial point of view and in addition offers certain advantages as regards construction and operation, the part shouldered by the railway should be increased.

In order to be able to fix the amount in question more easily, the following scale of percentages has been suggested :

Degree of interest	A from the commercial point of view	B from the operating point of view
1. No interest. . . .	0 %	0 %
2. Little interest . .	10 %	10 %
3. Average interest .	25 %	20 %
4. High interest . . .	40 %	30 %

The total of the percentages under A and B represents the amount the railway is prepared to contribute towards the cost of making the siding (purchase of the site excluded), which will therefore not exceed 70 % in the most favourable cases.

The assistance given by the railway consists essentially in providing material and labour.

2. *Depots at the stations.*

A great many Administration allow, in fact encourage the setting up of depots or even factories nearby the station, without a private siding.

Although the conditions of ownership are very different, this facility from the point of view of door to door technique is very similar to a private siding.

As one Administration (S. N. C. F.) pertinently points out, it can be said that the private siding is a station at the clients' premises, whereas a site rented to a client at the station represents the inverse situation.

In France, the setting up of such depots at stations is encouraged by refunding up to 9/10ths of the fees charged the client in question. The amount refunded depends moreover on the traffic given to the S. N. C. F.

In Holland, clients' depots at stations are usually owned by the client, although built on sites rented from the railway. The harbour installation at Amsterdam are owned by the municipality of that city, but operated and maintained by the railway. At Rotterdam, the harbour installations on the other hand are owned in common by the municipality and the railway. They are operated and maintained by the latter at common costs.

Ad. 1 & 2. — The following details show the importance of private sidings and client's depots in stations.

In France, the S. N. C. F. estimates that approximately :

— at least 40 % of the total tonnage carried can be attributed at the present time to private sidings (including clients' depots in stations and harbour installations);

— about 40 % of the same total tonnage can be attributed at the present time to traffic between stations and sidings (including clients depots in stations and harbour installations) and vice versa.

The S. N. C. B., in the course of an enquiry carried out in 1947, obtained the following results :

a) between private sidings (not includ-

ing station depots and harbour installations) : 36 % of the total tonnage;

b) between departure stations and private sidings (including station depots and harbour installations) : 13 % of the total tonnage;

c) between private sidings and arrival stations (including station depots and harbour installations) : 34 % of the total tonnage.

This amounts to saying that in Belgium, taken as a whole, 83 % of the traffic goes through at least *one* private siding.

In Holland, 7 % of the total tonnage is carried between private sidings (including the harbour installations), whereas 14 % is carried between stations and private sidings and inversely 29 % from sidings to stations.

In Italy, out of 3 516 734 wagons loaded on the State Railways, 23 % were loaded on private sidings and 26 % unloaded on private sidings.

Out of the 37 958 270 tonnes loaded over the whole system, 28.6 % were loaded at the ports and 60 % consigned to the ports.

The German Federal Railways report that in May 1951, 47.5 % of the wagons running on its lines came from private sidings or were going to private sidings.

In Austria, about 29 000 wagons were exchanged in June 1951 between stations and private sidings (including station depots and the ports) and vice versa.

This traffic is divided up between 976 sidings.

During this same month, about 25 000 wagons were loaded or unloaded at the 4 527 station depots.

In view of the fact that a total of 154 000 wagons were loaded in this same country during this same month, a figure which corresponds in fact to 308 000 terminal operations, about half the traffic was dealt with either at private sidings or on the lines available to clients at station depots.

We give hereafter (see table I) a synoptic statement for the eight above mentioned countries, though the information received relates it is true to different basic elements and periods, so that they cannot be compared as they stand.

On the whole these data, in spite of their diversity, give a true picture of the traffic which goes on private sidings and the interest lying in their active and methodical development as regards the improvement of the door to door technique.

3. *Wagon-conveying trailers.*

In 1950, the *Bulletin of the Congress* (see issues for April and May) gave numerous details concerning the origin, type and special technical characteristics, as well as the conditions of use and ownership of wagon-conveying trailers. A few comparisons between the cost of the ordinary type of haulage and transport by means of trailers of this type completed this information.

From the replies received, it appears that the use of wagon-conveying trailers for the terminal transport is increasing and they are now in use in the following countries : Italy, Austria, Belgium, France, Germany, Czechoslovakia, Sweden and Switzerland. Denmark is studying them. The synoptic map given hereafter gives a general view of the evolution of this method in the different countries (fig. 1).

In Italy, where the use of wagon-conveying trailers is already very widespread, 78 tractors and 178 trailers belonging to the railway and 56 tractors and 28 trailers belonging to private owners are now in service in 117 localities. The types of trailers and tractors were described in 1950. It may be added that at that time none were privately owned, but it was considered desirable that clients should acquire them in order to keep them interested in railway transport. This has occurred in the meantime; it is thus in the experimental stage.

The Italian Railways stress the fact that the advantage of delivering the wagon to client's premises is much liked, and it is to this preference that the progressive

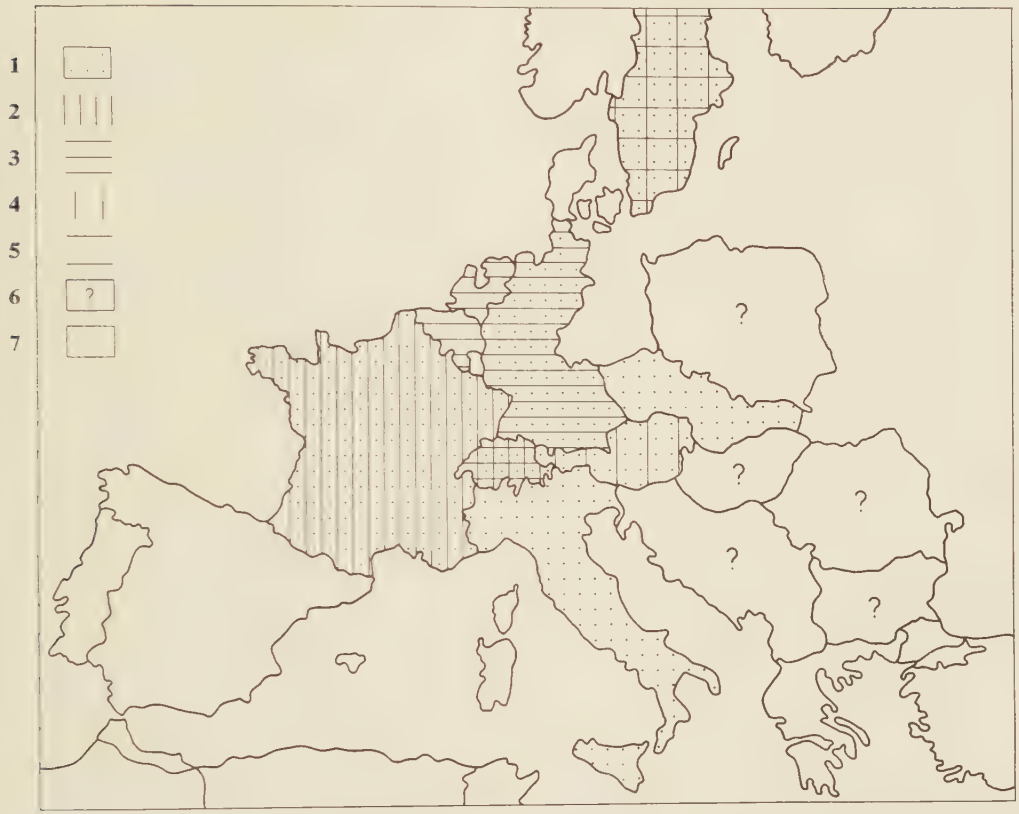


Fig. 1. — Development of wagon-conveying trailers, rail-road trailers and large containers with special carriers.

Explanation :

1. Wagon-conveying trailers.
2. Rail-road trailers.
3. Large containers with special carriers.
4. Proposed wagon-conveying trailers.
5. Proposed large containers with special carriers.
6. Railways which did not reply
7. Railways which do not use either wagon-conveying trailers, rail-road trailers nor large containers with special carriers.

expansion of the wagon-conveying trailer services can be attributed in view of the modest development of containers in Italy up to the present.

In Germany, wagon-conveying trailers are now able to deal with all types of wagons. Special arrangements have to be made with wagons with four pair of wheels. Even special low-loading wagons can be taken to client's premises with loads of as much as or even more than 100 t.

The German Railways in addition have just put into service a new type of trailer with pneumatic tyred wheels. The suspension springs are also pneumatic. An auxiliary hydraulic tilting gear (braquage) completes the advantages of this machine which can be used both for narrow gauge (from

TA

Traffic to ports, station depots and p

TRAFFIC	Designation	*D.B.* *Germany*	*Ö.B.B.* *Austria*
		%	%
from a port	A		
from a siding or depot	B		
of a siding, depot or port	C		
to another siding, depot or port	D		
towards a siding or depot	E		
towards a port	F		
Total of the consignments and arrivals (terminal operations)	$A+B+C+D+E+F = \Sigma$		5
Wagons from a siding (depot or port) to another	C+D		
Wagons leaving or arriving at a siding depot or port	2A+2B+2E+2F+G		
Traffic touching one or two sidings, depots or ports	C+D+G=H	47.5	
Traffic which does not touch *any* siding, depot or port	100-H	52.5	

(1) Of which traffic in large containers 2.5 %.

(2) A.O.F., A.E.F., Cameroons, Madagascar, Indochina.

as % of the total wagon traffic.

N.C.B. *elgium*		*S.N.C.F.* *France*		*N.S.* *Holland*		*F.S.* *Italy*		*C.S.D.* *Czechoslovakia*		*Overseas France* (2)	
	%		%		%		%		%		%
		A+B See below	=	A+B	14.5	A	14.5				
						B+C	11.5				
	18.0			C	3.5					C	2.5-10
	18.0	D	20	D	3.5					D	2.5-10
						D+E	13.0			E	10-40
F	6.5	A+B + E+F	20	E+F	7.0						
						F	3.0				
	59.5		60		28.5		42				
	36		40		7.0						5-20
	47		40		43.0						
	83		80		50				65		
	17		20		50 (1)				35		

750 mm : 2′ 5 1/2″ gauge) and standard gauge vehicles. In addition, when running unloaded, this trailer can be brough down to the standard road vehicle size and thus run at 40 to 50 km (25 to 31 miles)/h, a speed which it can moreover reach when loaded.

In Switzerland, the C. F. F. have set up transport services in certain important localities by means of wagon-conveying trailers. As a general rule, the vehicles working these services belong to the railway (1). In one case, however, the tractor is owned by an official haulier who is responsible for the service, whilst the wagon-conveying trailer belongs to the private firm which chiefly uses it.

Various trials carried out on behalf of large firms gave good results and several of them are considering purchasing tractors and wagon-conveying trailers, it being understood that they will install the necessary sidings in their premises if need be.

In Belgium, the S. N. C. B. have never wished to work the wagon-conveying trailer system themselves up to the present in view of the very high cost of these machines and the tractors needed to haul them. Only one case is reported from Belgium; the road vehicles belong to a factory which cannot be linked up with the railway. The use of this special stock is limited to traffic to and from the factory and the nearest station.

France (S. N. C. F.), which also uses wagon-conveying trailers, says that they find these cost less than ordinary haulage by lorry when the number of wagons consigned or delivered reaches *four* a day.

(1) Five road tractors of 100 brake HP and nine wagon-conveying trailers are in service, four tractors of 100 to 130 brake HP and four trailers are under construction. The Italian type 16 wheeler trailers with twin tilting gears (braquage) can take a 40 t wagon. They can take a curve of 8 m (26′ 3″) radius. The drawbar and loading ramp can be placed at either end of the trailer, so that it can run either way. All the wheels are braked by means of compressed air brakes.

In an *eight-hour* day, the traffic worked in France by a wagon-conveying trailer may be :

— 18 single runs when the distance between station and premises is 1 km (1 093 yards);
— 14 single runs when it is 3 km (1.8 miles);
— 10 when it is 5 km (3 miles);
— 8 when it is 8 km (5 miles);
— 6 when it is 10 km (6 miles).

In Austria, the Oe. B. B. are working wagon-conveying trailer services at four stations by means of 8 Culemeyer articulated trailers.

The question, which is the subject of the present report, stressed the economic side of door to door services, so we thought it useful to ask the railways to answer the following questions :

a) *What manipulations are necessary?*

b) *How many men are needed?*

c) *How long does it take?*

d) *What is the cost of the methods used in 1951?*

e) *What is the average duration of life of the said methods?*

f) *What amortization rates are in force?*

g) *What quantity of fuel or power and lubricating oil is used for the transhipment operations on the one hand, and for transport on the other?*

h) *Can you give any figures for maintenance and repairs (per annum and per km)?*

i) *Average speed from one end to the other (i.e. from the station to the premises and vice versa)?*

The following table II sums up the replies received. The details given varied considerably according to the country, which is easily explained as the equipment available is not of a standard type.

B. — *Taking the body of the wagon to client's premises, as a unit or in small unit (containers).*

1. *The whole wagon body.*

None of the railways consulted actually

transport whole wagon bodies in connection with their door to door services. This process has the drawback of requiring powerful and costly cranes to handle the bodies at the stations and heavy lorries which are not suitable for carrying out a flexible and fast terminal service. When no wagon-conveying trailers are available or such a method is too costly, it is therefore necessary to divide up the wagon body into a certain number of more easily handled units if full loads or large consignments are to be transported to destination without transshipment. The Austrian Railways report for example that in Austria privately owned wagons, specially designed for the transport of milk are fitted with tanks, which can be lifted off by cranes and put on lorries. They have hired out a certain number of chassis to the firms concerned, such chassis being registered among their stock as privately owned wagons, but this system is in fact similar to transport by means of containers which is dealt with below in chapter 2 *c*.

2. *Large containers.*

a) *On special carriers* (*).

The technique of transporting large consignments or full loads from door to door by means of large containers with special carriers is still not widely known. Although only of recent introduction in several European countries, it is developing surprisingly fast (1). The use in Belgium, Germany and Switzerland of the method first used in Holland (tractor with D. A. F. trailers) has given a new impulse to the traffic in large containers. At the Rome Congress in 1950, this technique was already the subject of an investigation. We will therefore merely report the improvements made since then as well as new methods, which have been developed in the last few years.

In Germany, in particular new types of trailers and half trailers for containers have been designed.

Although the German system of large containers was inspired in principle by the Dutch system, it differs on several points. These differences are due to technical considerations, constructional details, or to the general economy, or are the result of transport conditions special to Germany. In spite of these differences, the German stock is interchangeable with the Dutch. German containers can be loaded onto the Dutch wagons. In addition, whether they are loaded on German or Dutch wagons, such containers can be handled by either the Dutch or German trailers and tractors. In the same way, the Dutch containers can be handled by the German road vehicles.

As a first stage, the German Federal Railways put into service in 1950, 1 000 large containers, i.e. 250 open and 750 covered, as well as 333 wagons specially designed to carry them and 50 road vehicles. This was the experimental stage, which has now been passed and successfully concluded, as this Administration stresses. After a few initial difficulties, which have now been overcome, the demand for these new large containers has now grown to such an extent that the stock of 1 000 containers is altogether inadequate and 1 000 additional containers had to be ordered in 1951. Railway clients have been quick to see the saving in labour and packing costs obtained with containers, not only in the case of goods sent in bulk such as cement, sugar, cereals, etc., but also for other goods.

According to recent statistics published by the German Federal Railways, there are more than 80 different kinds of goods, which can be transported in large open or covered containers (1). These data show that the transport of cement in sacks represents 13.8 % of the consignments sent in closed containers and that the transport of this same category of goods in bulk represents 33.3 % of the consignments sent in

(*) In the text, the letters p. a. means « porteur aménagé » or on special carriers.

(1) See the synoptic map fig. 1, p. 403/51.

(1) See *Bulletin No. 6, Dec. 1951, of the International Container Office.*

TABLE II.

Factors used in calculating the cost of transport by means of WAGON-CONVEYING TRAILERS.

	Germany D.B.	*Austria Ö.B.B.*	*France S.N.C.F.*	*Italy F.S.*	*Sweden S.J.*	*Switzerland C.F.F.*	*Czechoslov. C.S.D.*
Currency :	D. M.	Schill.	Fr.	Lires	Kr.	Fr.	Cr.
A. FIXED COSTS :							
Purchase price :							
Tractor	...	...	5 mio	8 mio	20 000	90-100 000	...
Trailer	40-50 000	16 000	5 mio	4 mio	45 000	50-55 000	...
Expected life :							
Tractor	...	...	15 years	20 years	...	20 years	...
Trailer	...	20 years	20 years	25 years	...	20 years	5-10 years
Tyres	...	50 000 km	...	...	...	35 000 km	...
Amortization period :							
Tractor	...	...	15 years	...	...	10 years	...
Trailer	10 years	20 years	20 years	15 years	...	20 years	...
Tyres	...	5 years	...	...	...	5 years	...
Amortization :							
As a % of cost price :							
Tractor	...	...	...	...	...	8.5	...
Trailer	10 %	5 %	6.0 %	5.5 %	...	3.5	...
Tyres	...	20 %	...	...	...	20	...
Maintenance and repairs :							
Tractor :							
Annual overhaul	...	...	...	...	...	6-8 000	...
Small periodic mainte-							

Small periodical maintenance and repairs . . .	...	...	3-400 000	250 000	...	4 % of the purchase price	...
Total fixed costs : (per working day)							
Tractor		171.66					
Trailer		190.74					
B. VARIABLE COSTS :							
Labour :							
Labour requirements per load (loading, unloading, journey)	3 h.	3 h.	3 h.	2 h.	(1) 1 h.	2 h.	(1) 1-2 h.
Time : to load	15′	6′	3′	10-15′	3′	5′-8′	...
to unload.		5′	3′		3′	2-3′	
Speed over the road journey (average)	10-20 km/h	10 km/h	12 km/h	6 km/h	10-12 km/h	10-12 km/h	...
Fuel (per 100 km) :							
Diesel	100 l	70 l	100 l	100 l	...	70-80 kg	...
Benzine.	—	—	—	180 l	...	—	...
Lubricant : per 100 km . .	0.5 l	2 kg	...	0.5-0.9 l	...	10 % of the cost of fuel	...

(1) The figure of 1 man appears to refer to the actual transport.

The factors relating to the necessary manipulations given by the railways are not included in the above table, as these have been examined previously (1950).

The Austrian Railways report that their costs are lower than the amount the clients are charged for transporting the wagon to and from their premises, in spite of which the charges are much lower than the cost of transporting goods to client's premises by ordinary road vehicles.

open containers (containers sheeted of fitted with covers to make sure they are watertight). Another interesting fact should be noted : the traffic between Germany and her neighbours (Great Britain, Belgium, Luxemburg, Holland and Switzerland) has developed to a most satisfactory extent; it represents on the average 15.5 % of the total traffic, exchanges with Holland coming at the head and accounting for 4/5ths of this percentage.

The German containers, whose tare is less than 1 ton, can take a useful load of 5 tons. Their dimensions are as follows :

Category	Useful volume	Internal dimensions		
		Length m	Width m	Height m
Covered	12 m³	2.80	1.90	2.00
Open	8 m³	3.00	1.80	1.42

When fully loaded they can stand buffing shocks at 15 km (9 miles)/h without permanent deformation.

The constructional details of the large German containers, both covered and open, were given in Bulletin No. 4 of the International Container Office, December 1950. They remain the same to date, except that it is proposed to fit the end walls of open containers with special openings to facilitate emptying the containers.

Special prototype containers have also been built for the transport of liquids and for transport of goods that have to be carried at a given temperature or at very low temperatures. Special containers of this sort are usually supplied by the users, who receive a subsidy from the railway.

The tractors and trailers used in transporting the containers from the station to client's premises and vice versa do not all have the same output. Their user varies on the contrary a great deal according to the amount of traffic from private sidings and traffic with abroad. In the most favourable cases, the road vehicles have a daily output of 20 containers and more.

The number of road vehicles is adapted to the requirements of a stock of containers increased, as we have just seen, to 2 000 units (750 closed and 1 250 open).

It is estimated that nearly 1 000 stations can be served today by large containers with specially adapted carriers belonging to the railway; but in actual fact the possibilities of this system are far from being fully utilised.

In places where the importance of the traffic justifies it, the German Federal Railways have put in service a tractor entirely hydraulically operated for use with large containers. It is single man operated however used. This is a tractor fitted with a pivoting and tipping frame, built of high tensile steel, electrically welded. The chief feature of this vehicle is that the frame can pivot 90° to the right or left if lifted 30 cm (11 13/16"). When the frame is raised, a hydraulic gauge shows the weight of the container.

The trailer can consequently be loaded and unloaded either from the back or from either side, the frame tipping in these three directions at an angle of 42°. The gear is operated from the back, on the left hand side of the trailer (see fig. 2 and 3).

In place where there is not sufficient traffic for these road vehicles to be used inten-

Fig. 2. — *Germany*. Road trailers, unloaded from the side.
(*Eckermann* patent, Wuppertal.— Photograph by Toussaint and Hess, Dusseldorf.)

Fig. 3. — *Germany*. Road trailer, unloaded from the rear.

sively only on carting containers, they can be used for other jobs which fit in with their method of construction. For this reason, apart from road vehicles specially designed for the transport of large containers, they have also tried to use a vehicle on the same lines as a lorry with the usual type of body but equipped with a device over the rear end of the vehicle by a device fitted *for this purpose*. The articulated chain is worked by the tractor engine (p.t.o.).

We will also mention another road vehicle (motor-trailer) recently designed in Germany, which has a loading platform for containers similar to that of a lorry; the

Fig. 4. *Belgium*. Open containers p. a.

to load a container from the ground or from a wagon and dump it.

This vehicle, which costs much less than the special trailers, is needed above all in localities where the latter could not be fully utilised. It is in fact an articulated lorry, consisting of tractor and trailer able to carry a useful load of 6 tons, which corresponds to a loaded container. An articulated chain fitted on the floor of the lorry is used to move the container, which can be both pushed and pulled and even tipped vehicle is driven from the front end, being equipped with a « VW » engine.

The driving compartment can pivot round completely, which is a great advantage for controlling the loading and unloading of containers.

The loading and unloading is supervised by a single employee. The manœuvrability and flexibility of the vehicle, which thanks to its pivoting cab, makes it possible to get an angle of 360° for turning in either direction, makes it worthy of special men-

tion. The maximum load of this vehicle is also 6 tons, and its maximum speed 16 km (10 miles)/h.

In Switzerland, the C. F. F. (1) are perfecting equipment (removable device [fig. 7-8]), which can be fitted on standard lorry floors and makes it possible to transport large containers in places where the use of a D. A. F. carrier, i.e. a tractor and trailer like those used in Holland, cannot be justified.

In Belgium, the S. N. C. B. also has 100 special wagons. Containers are delivered and collected as in Switzerland from a certain number of centres, around which tractors and trailers like those used in Holland are in service for the terminal transport.

Fig. 5. — *Holland.* Tank containers p. a.

The Netherlands Railways which already have several years experience of D. A. F. carriers in the field of terminal transport, stress once again the advantages of this system. We will not go into details of the

(1) The Swiss Federal Railways, who bought 138 containers, as a first stage, are going to complete their stock and increase it in the near future to 300 units corresponding to 100 special wagons. They have 10 tractors with trailers of the Dutch type (van Doorne).

Fig. 6. — *Switzerland.* Covered containers p. a.

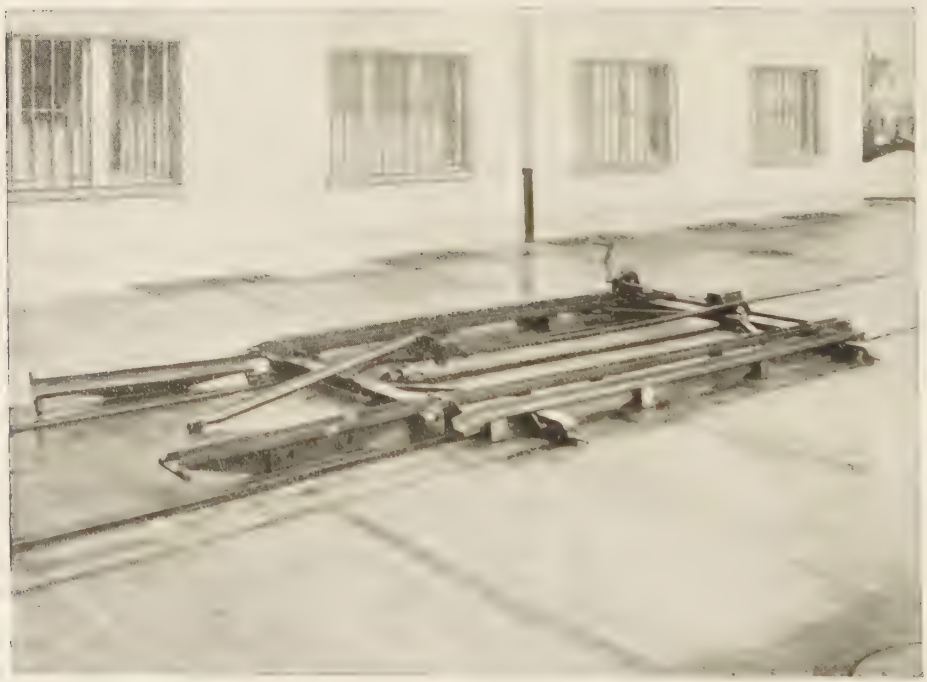


Fig. 7. — *Switzerland.* Removable device to put on the floor of ordinary lorries used for the transport of containers p. a. (weight : 260 kg) to client's premises.

Fig. 8. — *Switzerland.* Removable device for containers p. a. fixed on a lorry and ready to be used. (The Swiss p. a. containers are fitted with 4 wheels on each side, two of them, on which the container rests during its passage onto the lorry, are inside.

technique, which was already explained at the Rome Congress. The Netherlands Railways report that the cost of the whole of the transhipment and terminal transport when a D. A. F. carrier is used is lower than in the case of a motor lorry, provided a reasonable user of the carrier is obtained. In Holland, the best user is obtained in the case of transport over distances of about 5 km (3 miles). In this country the average distance for haulage does not exceed 5 to 6 km (3 to 3.7 miles). Used in this way, the D. A. F. carrier is entirely satisfactory from the point of view of cost. Three types of containers with special carriers are used in Holland : open and covered containers and tank containers. The question of the transport of cement in bulk is being studied.

We sum up below the operations and minimum time required to transport and deliver, then return to the station and reload large containers of the Dutch type.

Outward journey :

Unfasten the container . . .	3 min.	
Bring the trailer up and fix the rails	2 min.	
Tranship the container . . .	2 min.	
Fasten the container on the trailer	2 min.	
		= 9 min.
Road journey of say : 3 km (1.8 miles)		8 min.
Unload the container on to the ground		3 min.
Business dealings : conveyance note		5 min.
		25 min.

Return journey :

Reload a container	3 min.	
Road journey of say 3 km. .	8 min.	
Bring the trailer up to a wagon and fix the rails	2 min.	
Unfasten the container on the trailer	2 min.	
Tranship the container . . .	2 min.	
Fasten the container on the wagon	3 min.	
		= 20 min.
Total . . .		45 min.
Addition if there is no load for the return run : 2 × 8 min.		= 16 min.
		61 min.

The Netherlands Railways state that the average tonnage per hour dealt with by means of a D. A. F. carrier is :

a) covered containers . . 7.5 tonnes;

b) open containers . . . 10 tonnes.

These figures include the time required for haulage, taken as an average of 20 minutes for each outward and return run.

During an 8 hour day, the Netherlands Railways usually handle 8 covered or 12 open containers.

The following table III sums up the replies received to questions identical with those asked in the case of wagon-conveying trailers (see chapterA 3), in order to collect together comparative data to facilitate ascertaining the cost prices.

b) *Special containers with special carriers for the transport of cement.*

The problem of the door to door transport of cement in bulk has had particular attention, and special containers are being increasingly used for this type of traffic. Many of the railways consulted are preoccupied with improving the conditions under which cement can be transported by means of containers. The relatively high percentage of transport carried in this way in Germany shows the importance of this problem for the railway. It appears therefore opportune to complete the details given previously in connection with the transport of full loads by containers, and give details of the technique which, principally in Italy, Portugal, Austria and Switzerland, is meeting with a favourable reception by those responsible for building dams and hydro-electric plants in mountainous regions. This technique was originated in Italy.

The method used is as follows : the cement, instead of being sacked at the plant is put into plate containers (fig. 11) which take 400 kilos (8 cwts.). These containers are placed on flat wagons to which they are fastened by special devices perfected by a specialist firm (1). This device consists of pairs of rails set across the wagon and fitted with rollers on which the containers can slide.

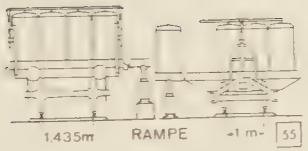
The flat wagon with a standard load of 20 t has 12 such pairs of rails. Four containers can be placed on each pair, so that the load usually consists of 48 containers. This represents 48 × 400 kg = 19 200 kg (appr. 19 tons) of cement.

In Switzerland, for example, to carry supplies to a hydro-electric plant in the Upper Aar Valley, which has now been completed, the standard gauge railway was used first of all up to Interlaken-Ost, then the narrow gauge line from Interlaken-Ost to Innertkirchen, and, finally, a lorry from Innertkirchen to the site in question.

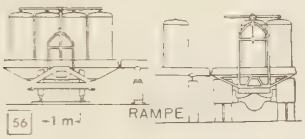
To transport the containers to Interlaken-Ost, between the standard and narrow gauge railways, there was a special platform fitted with the same device as the wagons which could take 430 containers. On one of the platforms slightly inclined towards the narrow gauge line, so that the rolling would be helped by gravity, full containers were transhipped from the standard gauge wagon to the narrow gauge vehicle, which actually was a transporter truck from the Brunig line on which 15 pairs of cross rails

(1) The « S. A. des Transports » at Zurich, who kindly has supplied to us the fig. 9 to 11.

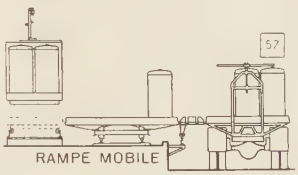
Fig. 9. — *Switzerland.* The rollers on which the containers slide.



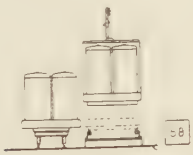
Sketch 55. — Transhipment from standard gauge wagon to narrow gauge wagon.



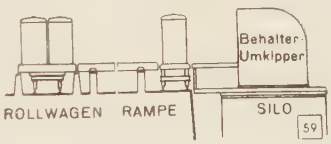
Sketch 56. — Transhipment between the narrow gauge wagon and the lorry.



Sketch 57. — Transhipment at the bottom station of the telpher line from the lorry to the carrying bucket.



Sketch 58. — Transhipment at the upper station of the telpher line from the carrying bucket to the Decauville truck.



Sketch 59. — Transhipment at the site from the truck to the silo.

Fig. 10. — *Switzerland.* The five phases of transhipping containers loaded with cement.

were fitted to take 60 containers. In a maximum of 10 minutes a standard gauge wagon was unloaded and a transporter truck loaded.

The second platform was used for the transhipment of empty containers on the return journey. One part of this platform, the same length as a transporter truck with room for 60 containers could be raised up by means of a hydraulic device in order to cancel out the difference in level between the truck and the platform which was

TABLE III.

Factors used in calculating the cost.

PER CONTAINER PA					PER RAIL-ROAD TRAILER		
Germany D.B.	*Belgium S.N.C.B.*	*Holland N.S.*	*Switzerl. C.F.F.*	*A.* FIXED COSTS.		*France S.N.C.F.*	*Switzerland C.F.F.* (4)
D. M.	Fr.	Fl.	Fr.			Fr.	Fr.
				PURCHASE PRICE			
35-38 000	165 000	7 500	58 000	Tractor	Tractor	1.6-2.1 mio	horse, motor, lorry
	290 000	14 000		semi-trailer pa			
	..	...	...	trailer pa	tank carrier		—
	.	...	...	lorry pa	tank trailer		8 500
					covered dray	0.9-1.3 mio	—
		2 800	5 000	tank container	covered trailer		7 000
	34 000	2 500	3 500	covered container	open dray		—
	20 000	1 600	2 500	open container	open trailer		6 000
	old	12 000	19 000	wagon pa	special wagon	1.45 mio	—
			15 000	adapted wagon	fixed installations at station	0.35-0.7 mio	—
				PRESUMED LIFE (in years)			
7-10		5	20	Tractor	Tractor	5-10	
		8		semi-trailer pa	dray	20	
				trailer pa	trailer		15-20
				lorry pa	pneumatic tyres		5
				tank container			
		10	20-25	covered container			
				open container			
		33	50	wagon pa	special wagon		—
					station equipment	50	
				AMORTIZATION PERIOD (years)			
(1)		5	10	Tractor	Tractor	5	
		8		semi-trailer pa	dray	10	—
				trailer pa	trailer		15
		10	20	container	pneumatic tyres		5

		12.5 %	10 %	semi-trailer pa	dray trailer	10 %	6 1/2
		10 %	5	container	pneumatic tyres		20
		3 %	2	wagon pa	wagon	2 %	—
				MAINTENANCE AND REPAIRS			
(1)		1 500	6 000	Tractor semi-trailer	Tractor trailer	280 000 85 000	
		...	...	container	wagon : revision	55 000	
		...	...	wagon	wagon : maintenance and repairs	55 000	
				B. VARYING COSTS			
				LABOUR			
1	2	1	1	No. (men) : moving manually mechanically		— 1-2	2 1 (3)
10 5	2 × 3′ 2 × 3′	2×3′ (2) 2×2 1/2(2)		Time : handling at the station (min.) handling at client's premises (min.)		1-1.5 —	5
2-3 25-30 18	1 × 3′ 15	25-30	15-45	To tip Speed on the road Speed : trailer motor unit only	... (average) (km/h) ...	according to the tractor	25
				FUEL AND LUBRICANTS SOURCE OF POWER			
		50	50	Petrol : litres per 100 km (62 miles)		—	—
				Diesel oil : litres per 100 km		18-25	—
			10 % of the fuel	Lubricant : litres per 100 km			

(1) Insufficient experience for any details to be given.

(2) In the case of Holland, see also detailed table pages 415/63 and 416/64.

(3) By horse, motor, lorry or tractor.

(4) The details given about Swiss rail-road trailers relate to the prototype being built, developed by a private firm this vehicle which is lighter than that shown on page 423/71.

Fig. 11. — *Switzerland*. The transhipment of the containers from the wagon to a lorry.

slightly inclined in the opposite way from the other platform, towards the standard gauge line so that gravity would again help the containers to roll in this direction.

A similar transhipment installation was used at Innertkirchen to unload the containers onto the lorries and vice versa. The lorries were also fitted with pairs of rails on which to slide the containers, which were then taken by the Grimsel road to the site where the cement was tipped into two silos each holding 1 000 t.

At the cement plant the containers were already on the wagon when loaded which was done in groups of 8 units. To load a wagon took only about 15 minutes.

At other sites unlike the Upper Aar Valley, the containers have to be transported between the rail terminus and the site high up in the mountains (for example at 2 400 m [7 870 ft.] in the case of the Cleuson Dam in the Valaisannes Alps) by means of a telpher line. A double transhipment platform like that used at Interlaken or Innertkirchen is again used between the railway and the telpher railway.

The Cleuson telpher line carried 20 tonnes of cement an hour to the site, where there were four silos each holding 850 t.

Fig. 12. — *Italy*. Large F.S. container (U.I.C. type) for the transport of perishable foodstuffs.

c) *Other large containers (ordinary or special types).*

Although, owing to the great advantage of the ingenious unloading device (D. A. F. or other more recent types, such as the Weeser, Ackermann, von Lienen, etc.) the use of the large containers on special carriers is being generalised in several countries; large containers, ordinary or special, loaded onto ordinary flat wagons — i. e. not specially arranged in any way — continue to be used in large number of most of the railways. These containers with or without feet must be suitable for picking up by cranes and fastening onto the wagons by chains or cables. In Austria, for example, the Federal Railways are going to purchase some large containers without having built any special carriers for these.

Though large containers, ordinary or special, are widely used, it is nevertheless true that the inadequacy or lack of lifting gear to tranship large containers from the wagons to lorries and vice versa is still a great handicap as already tressed at the Paris Congress (1937). This drawback will persist as long as costly installations and equipment, such as electric cranes, fixed pivoting electric cranes, automatic cranes on pneumatic tyres, etc. are not available

at certain stations or at the premises of the consignor or consignee, as is still often the case (see chapter II).

It is true that when no lifting gear is available at the client's premises, the container can be left on the road vehicle (trailer, dray or lorry), whilst it is being loaded or unloaded.

However, in view of the present possibility of using large containers between a certain number of centre - stations (France), designed on modern lines and *well equipped* (mechanical lifting gear, etc.), this handicap can be appreciably diminished. This method of operation also facilitates the intensive user of mechanical equipment and also assures a better turnround of the containers and rolling stock.

At the Rome Congress, the improvements and innovations made by the railways in connection with transport by means of large containers of all kinds were dealt with in the case of full loads, so that we will not go into them again.

Many studies on the development of containers and the present ideas concerning the transport of small loads have been published in recent years (1). The International Container Office (B. I. C.) and the U. I. C. published in common in September 1949, on behalf of the Committee of Internal Transport of the European Economic Commission a note giving details of the studies carried out under the aegis of the U. I. C. and B. I. C. in order to decide the technical standards and suitable regulations to encourage the wide scale use of the containers in international traffic.

If the improvement of the technical methods used for terminal transport is an essential factor in increasing the efficiency of the door to door services, the codification of the technical conditions and régulations regarding changes of traffic, as well as the creation of a typical tariff for the transport of goods in containers and for the transport of empty containers in international traffic is no less important.

Here the good work done by the U. I. C. and B. I. C. should be stressed, in contributing to facilitating the exchange of containers and also to giving a new impulse to this traffic by their recent revision of the different U. I. C. notes (31, 91, 111, 120, 192 abd B. 20).

The additional agreement to the C. I. M. regarding containers, signed by 17 States in May 1951, under the aegis of the Central International Transport Office also is worthy of note.

These various and fortunate measures of co-ordination, added to the efforts of the B. I. C., which is doing all it can to make known the best types of containers and to recommend the construction of such types, cannot fail to have an effect on the development and speeding up of transport by means of containers, and consequently upon the improvement of the door to door services.

3. *Rail-road trailers.*

The question of rail-road trailers was also gone into at the last Congress, and their characteristics considered in detail. In the present report we will therefore limit ourselves to giving the factors on which the costs are based in France and Switzerland and would ask readers to refer to table III, pp. 418/66 - 419/67.

To complete the information given previously about rail-road trailers, the reporter thinks it is necessary to mention briefly the trailer perfected in recent years by a Swiss

(1) See in particular the *Revue Générale des Chemins de fer*, March 1951, pp. 101 to 123, article by M. JOUFFROY : « The systematic substitution of the moveable body (container) for the fixed body in railway transport. »

See also the article by Professor W. BÄSELER which appeared in *Bulletin No. 6* of the B.I.C., December 1951 : « The powerful co-ordinating effects of complete train loads of containers » and that by the same author appearing on the 17h November 1951, in the review *Schweizerische Bauzeitung* under the title : « Die Eisenbahn ohne Weiche « (The railway without points).

firm (1) in collaboration with the manufacturers and the C. F. F. (see fig. Nos. 13 and 14). The inventor tried to design a vehicle which could be easily moved, both manually and by horse, motor, lorry or tractor. He also had in mind a vehicle which could be loaded onto any ordinary wagon whose sides could be let down.

This trailer which might in fact be called a large container on wheels consists of a frame on pneumatic tyred wheels, a frame made of steel sections to which a 50 hl (138 bushels) tank is fastened. The axles are square in section, cranked in SM steel. The full lock at the front end makes it easy to turn the machine which can turn in 4.5 m (14′ 9″) radius. The solid wheels with round hubs take 750 × 15 × 12 tyres (1).

They are easily loaded onto a wagon from a side platform. As the vehicle is loaded sideways on the wagon, it is easy to stow and fasten it. Although in principle, it is possible to load the trailers without any special arrangement of ordinary wagons provided the sides fall down, the trailers which at the present time are being used to carry beer, once loaded onto a wagon no longer rest on the pneumatic tyres but on a fixing device as can be seen

Fig. 13. — Rail-road trailer, Swiss type, loaded onto special carrier.

(1) Brasserie Feldschlösschen at Rheinfelden (Switzerland).

(1) See *Bulletin No. 4 of the International Container Office*, December 1950.

Fig. 14. — Horse-drawn trailer.

in the photograph. Two transversal wedges are fastened to the floor of the wagon, on each side of the frame, each of which is surmounted by a rail which serves as a guide for the small steel wheels, which take the load and are a guarantee of safety during the journey.

This in fact is the same sort of fixing device as that used with the rail-road trailers used in France (1) but placed transversely across the wagon and having a different form.

As the S. N. C. F. recall, the use of the French rail-road trailers necessitates certain special installations in the stations and a special type of wagon to carry them. On the other hand, the normal station installations can cope with the Swiss prototype just described. However, special wagons are used for safety reasons the trailers should be wedged and stowed on special sleepers fixed to the floor of the wagon as described above.

(1) See *Railway Congress Bulletin* for April 1950, fig. 5, pp. 345-21.

The S. N. C. F. sums up the advantages of the rail-road trailer used on their system as follows :

— excellent user of the loading platforms: a rake of 20 trailers only takes half an hour to load;

— excellent user of the wagons carrying them: the average annual user of one of the special wagons is twice as high as the average user of an ordinary wagon;

— simplification of the shunting;

— rapidity of handling;

— fewer lawsuits owing to the excellent suspension of the stock and the reduction in handling operations;

— rapidity and regularity;

— possibility of offering clients any type of vehicle.

II. Full loads transhipped at the station.

A. — *Transhipment by mechanical means.*

1. *Technical means belonging to the railway.*

These are mostly the classical methods, which were the subject of a detailed analysis in 1950; only the new motor cranes deserve special mention, owing to the importance attached to them by the railways in the chain of terminal operations, due to the ever increasing use of large containers.

The types of motor cranes in use in certain countries, especially in Denmark, Sweden, France (including Overseas France), Algeria and Holland were described at the Rome Congress.

The S. N. C. F. stresses the fact that its cranes are not machines mounted on a lorry but real motor cranes with a driving cab from which the driver can carry out all the necessary handling and driving operations. They make it possible to deal rapidly with loads weighing up to 6 tons and to handle goods in bulk (sand, gravel, coal, etc.) by means of a bucket (electric or other) which can be suspended from the beam without taking down any parts of the crane. They can travel very easily on the road and go from one station to another or from the station to client's premises if necessary, pulling a trailer weighing up to 6 tons.

The Netherlands Railways which use Coles mobile cranes report that the high cost of this machine is a drawback, since it costs a great deal more than an ordinary station crane.

In Switzerland, the C. F. F. are now carrying out trials of motor cranes in order to complete their terminal equipment.

In Austria, the Oe. B. B., who have no motor cranes, have put 16 crane-wagons at the disposal of clients. The rates for using them are laid down in the goods tariffs. This Administration stresses that the use of mechanical methods of transhipments from wagon to lorry and vice versa assists in keeping down damage. They add that the motorization of the station cranes gives a saving of 60 to 70 % compared with hand operation.

The following table IV shows the fixed and variable costs for the Austrian wagon-cranes, as well as those for the French and Dutch motor cranes.

2. *Technical means belonging to clients.*

To give door to door services, modern technique offers the use of very varying formulae, the choice of which will depend upon the kind of goods to be carried and on local conditions. These different methods are very often special machines designed to handle one type of goods or a single category of goods.

In the case of transhipment mention may be made of :

— weighty goods in bulk : elevators (hoists), cranes or gantries with pick-up buckets;

— goods in sacks or cases; pallet trucks,

TABLE IV.

Factors for calculating the cost of handling by crane.

	Austria Oe.B.B.	*France S.N.C.F.*	*Holland N.S.*
Currency	S.	Fr. fr.	Fl.
System	wagon	(1) motor	motor
FIXED COSTS :			
Purchase price	500 000	8 millions	40 500
Expected life . . . years	15-20	20	10
Amortization period . . . years		20	10
Amortization	10 %	5 %	10 %
Interest			2.4 %
Maintenance and repair . . . per year	1 400		1 600
per hour		(2) 250	
VARIABLE COSTS :			
Labour : number . . . man	3	(3) 2	1
Time : beet per net . . . minutes			1.5
coal per ton . . . minutes	—	(4) 2	—
sand per ton . . . minutes	—	(4) 1.25'	—
Road speed . . . km/h	—	25-30	5
Fuel :			
used for handling : 300 t per day (8 h)			
1 per day (1 l)		40	40
Lubricant :			
used for handling . . . kg per month	20	0.25	
1 per hour			
Fuel :			
used during transport per hour		8 l	
Lubricant :			
used on road runs per hour		0.25 l	

(1) Are only used quite exceptionally for transport to client's premises.

(2) These expenses include in part estimated figures, as the cranes in service have not yet had to undergo any overhauls.

(3) One employee operates the crane, the other, who can be the lorry driver, gives him the necessary information to ensure the bucket is filling up properly.

(4) Relates to transhipment from wagon to lorry, the crane being equipped with a bucket of 700 l capacity.

belt conveyors, conveyors (1) loader-elevators, if necessary in conjunction with pallets;

— liquids : pipe-lines, and motor pumps.

Transport by means of cables (telphers) (see also chapter I, B, 2 *b*) is also of great service. This has the advantage of taking up very little space and being able to get over obstacles without any costly structures.

In view of the great variety of technical methods of transhipment from the wagon to the road vehicle or from the wagon to client's premises and vice versa, the S. N. C. F. remarks that the information asked for under figure 6, letter *a* - *i* of the questionnaire (factors on which the calculation of costs is based) apart from the cases in which door to door transport is effectively obtained is of no real value.

The diversity of the machines used, the different conditions of user in different places and under different circumstances, the essential variations in the costs, the output obtained, for any given goods, the specific condition of these goods, etc., etc. make it impossible to compare these different factors in any satisfactory way. Each particular case must be examined on its own merits.

In Holland, apart from the railway cranes, the technical means used to tranship goods between wagons and road vehicles — or boats — (2) are essentially the property of the client.

In Italy mechanical means are hardly ever used for the transhipment of goods between wagon and road vehicle, except for the station cranes when needed.

(1) Conveyors both elevate and carry the goods along; brackets are fixed to the two traction chains but they can oscillate freely around the axis of suspension; this arrangement makes it possible for them to travel horizontally on the vertical plane. The goods are moved on by the action of the brackets.

(2) Conveyors, cranes (moveable or otherwise) moveable loading bridges, trolley, fork-lift trucks, D. A. F. unloaders.

B. — *Manual transhipment.*

Apart from the door to door transport obtained by the methods described above, the transhipment of goods from wagon to road vehicle and vice versa is still done manually in most cases.

Manual transhipment of goods is practised in particular by clients who only dispatch or receive a limited number of wagons.

The S. N. C. F. report that they have built a certain number of elevated runways to enable tank lorries to be unloaded directly into the wagons.

This Administration estimates the cost of handling by hand is nearly double that of a motor crane.

It is owing to the high cost of handling by hand — which tends to increase without any corresponding increase in output — that the railways have endeavoured to equip stations with heavy traffic with modern transhipment equipment by means of which very great productivity can be obtained from the capital invested.

We give hereafter in table V details of the tonnage handled per hour by the different methods used. Comparing more or less mechanized methods with the classical methods of transhipment by shovel or truck, it will be seen that it is practically impossible to make any but general comparisons, taking into account in particular the existing fixed installations which frequently decide what mechanical methods can be used.

III, Part loads and sundries collected into large consigments.

A. — *Small containers up to 3 m³ (106 cubic ft.).*

As we recalled in chapter 1 B 2, letter *c*, the U. I. C. and B. I. C., in their common note sent in 1949 to the Railway Transport Sub-Committee of the European Economic Commission, made a special point of the technical conditions and organization me-

TABLE V.

Details of the tonnage handled per hour.

	Belgium S.N.C.B. t	*France S.N.C.F.* t	*Holland N.S.* (1) t	*Switzer. C.F.F.* t	*Overseas France* t
GOODS IN BULK :					
by shovel		1.5		2-3	
by motor hoist		6			
by conveyor			20		
by blower				10-30	
moveable loading platform (sand)					
coal-tip wagon			20		
dumper (oil)			27.5		
motor crane, 700 l bucket		12-20			
motor crane, grab (-bucket)	25-30				
motor crane, beet nets			30-35		
1 500 l electric gantry		30-80			
GOODS IN SACKS :					
hand truck		2.5-3.0		4-8	
elevator-loader		5			
elevator truck (fertiliser)			18.5		
crane					20
sacks on pallets :					
hand elevators		12			
mechanical elevators		24			
VARIOUS GOODS :					
hand truck		1		1-3	
mechanical fork-lift trucks		3.5			
crane				8-12	10
on pallets :					
hand elevators		8			
mechanical elevators		16			
LIQUIDS :					
according to pump power		100 hl		3-5	

(1) The tonnage dealt with hourly by the Netherlands D.A.F. unloaders is shown under B, 2, a, page 416/64.

thods to be adopted to facilitate and extend the use of containers in international traffic. In the meantime, the Inland Transport Committee has also dealt with this problem (1). They decided to set up a Container Working Group responsible for defining and studying the various problems, which require governmental action in this field, without losing sight of the legal questions relating to the transport contract by rail which comes under the Central Office of International Transport by Rail. The Working Group met in December 1951 and made their first report. They decided in particular to adopt the word « container » in both English and French to designate the articles with which they were dealing. In addition, it was provisionally decided how a container should be defined and laid down that to qualify for this appellation a container should in principle have an internal volume of at least 3 m³.

As can be seen, several organizations are actively concerned for various reasons with the technical characteristics, standardization and conditions of use of containers of all kinds.

We wish to recall these facts as a preliminary before summing up the replies received concerning the best way of using containers for sundries.

QUESTION 1. — *Are the containers you transport owned by :*

a) *your Company;*

b) *an affiliated company;*

c) *a private firm which hires them out to the users;*

d) *firms which use them for their own business, i.e. for the transport of products manufactured or sold by them.*

In Belgium, Luxemburg, Denmark, Germany, Austria and Czechoslovakia, all small containers are owned by the railways. However, the Austrian Railways allow containers of special designs belonging to private firms to be registered amongst their stock of containers. At the present, however, there are no such containers.

In Holland, the railway administration generally owns the containers, though certain firms have some for transporting their own products.

In Italy, the small containers are owned by the railway; however they are all hired out to private firms who, in general, use them to transport their own products.

The Algerian Railways have their own containers, but a private firm also hires containers out to users.

In Spain, various firms are interested in containers. Some of these hire them out, whilst others use them to operate transport services. The R. E. N. F. E. has an interest in one of these firms.

Greece, Finland and Norway have no small containers to date, though Greece is considering purchasing some.

The containers used in Morocco belong to the Algerian Railway Company (which hires them out to users) or to private firms such as the North African Container Company (S. T. E. F.); certain firms also own some for carrying their own products. In Madagascar, privately owned containers are used for luggage; in French West Africa, they are used to carry wine, and in the Cameroons for consigning bitumen.

The Portuguese Railways have a small number of containers which, in general, are being used, experimentally, between Lisbon and Oporto.

In Sweden, the containers belong partly to the railway and partly to an affiliated or filial company.

In Switzerland, the railways have a certain number of small containers which they hire out to users, whilst private firms own a much greater number which they use to carry their own products.

(1) See the minutes of the seventh session of the Internal Transport Committee, held at Geneva, from the 3rd to the 7th July 1951.

QUESTION 2. — *Indicate the approximate division of the stock amongst these different categories.*

QUESTION 3. — *Which of these systems do you prefer?*

QUESTION 4. — *Explain why.*

In Belgium, the S. N. C. B. own 700 containers (1 to 1.2 m^3 = 35 to 42 c. ft.), 900 category B (1.2 to 2 m^3 = 42 to 70 c. ft.) and 200 category C (2 to 3 m^3 = 70 to 106 c. ft.).

The German Federal Railways on the 15th August 1951 owned : 18 802 category A containers (1 m^3), 16 041 category B containers (2 m^3) and 1 922 category C containers (3 m^3).

They definitely prefer to use only containers belonging to the railway, to enable the Administration to arrange the user of the containers according to traffic requirements. Thanks to the application of this principle, the average of empty runs compared to loaded runs oscillates between 15 to 20 % at the most. If privately owned containers, which most of the time can only be used for certain clients, were included in the railway's stock of containers to any great extent, they would usually have to be returned to their point of departure empty after a loaded run. This would considerably increase the proportion of empty runs, and for reasons easy to understand, the railway could no longer allow the tare of the container to be substracted when calculating the transport charges.

In France, the S. N. C. F. owns 46 % of the stock of containers and private firms 54 %.

The two methods are used quite separately. According to the traffic concerned, one or other is the most suitable. Certain consignors have not a sufficient volume of trade to justify owning a large number of containers if the S. N. C. F. could not provide containers, this traffic might be lost to other methods of transport.

Privately owned containers are essential for the consignment of certain kinds of goods (liquids for example).

The F. S. have 918 containers of one cubic metre capacity and 211 containers of more than one cubic metre capacity, some of which exceed 3 m^3 and do not come into the category with which we are now dealing. In Italy, the system of hiring them out to firms meets clients' requirements and also those of the railway. In view of the small number of containers in service, the F. S. do not think it would be economic if the railway set up a special department to deal directly with them.

In Holland, 396 containers of 1 1/2 cubic metre (53 cubic ft.) capacity belong to the railway, whilst 1 107 containers are owned by 7 firms. The N. S. prefer privately owned containers, stating that this system makes it possible to adapt the containers better to the special conditions required by the goods to be carried. In addition, the capital invested by the railway is limited.

In Austria, on the other hand, the opinion is that railway owned containers are preferable and the most advantageous for the Administration. This is also the opinion of Denmark, who considers that this system results in a reduction of empty runs to the minimum and leaves the railway greater freedom.

Spain only has 30 small containers of categories A and B. Luxemburg only uses containers owned by the railway.

In Algeria, 100 small containers of 3 m^3 capacity belonging to the railway, are in service, and have given satisfaction to clients.

The Swiss Federal Railways operate 342 containers of categories A and B (1.2 m^3 and 2 m^3) which belong to them. In addition 1 350 small containers of categories A, B and C belonging to private firms are included in their stock, together with a certain number of special containers for various heavy or liquid goods (milk, benzine, ether, etc.). This Administration puts forward the same arguments as the S. N. C. F. in favour of the two systems. They

report, like the N. S., that the purchase and maintenance of containers by different firms makes it possible to limit the number owned by the railway.

QUESTION 5. — *Do you use containers to group consignments of parcels traffic from one station to another?*

Only Sweden, Austria, Portugal and Algeria report the use of small containers to carry sundries in certain cases.

Belgium allows several containers from one consignor to various destinations served by the same arrival stations to be grouped together.

QUESTION 6. — *Give a detailed description of the different types of open or closed containers transported on your railway and state in particular :*

a) *material of which they are made;*

b) *rigid or pliable, with or without wheels;*

c) *internal dimensions and capacity in m³;*

d) *load in kg and tare;*

e) *cost of construction in 1951;*

f) *maintenance costs per annum.*

g) *what is the amortization period for the different types of containers?*

(See table VI hereafter.)

The Netherlands Railways state that privately owned containers included in their stocks show a great variety of sizes and materials of construction. So they merely gave the characteristics of some of the types used by two large firms.

Firm A :

a) Strengthened with iron pipes, the walls by braided iron wire.

b) 750 collapsible units, 50 rigid; all without wheels.

c) Two types :

1) 1 400 mm long, 650 mm wide, 720 mm high; capacity : 0.66 m³ (23.30 cubic ft.);

2) 1 180 mm long, 580 mm wide, 630 mm high; capacity : 0.43 m³ (15.18 cubic ft.).

d) 1) 150 kg;

2) 80 kg.

e) 1) 75 hfl;

2) 50 hfl.

f) Approximatively 20 hfl.
Amortization over two years.

Firm B :

a) Strengthened with iron piping, the walls with braided iron wire.

b) 90 collapsible, 30 rigid; all without wheels.

c) Two types :

1) 1 400 mm long, 700 mm wide, 750 mm high; capacity : 0.74 m³ (26 cubic ft.);

2) 1 200 mm long, 600 mm wide, 650 mm high; capacity : 0.47 m³ (16 cubic ft.).

d) 1) 400 kg — tare unknown;

2) 150 to 200 kg.

e) 1) 75 hfl;

2) 50 hfl.

f) Approximatively : 20 hfl.
Amortization over five years.

QUESTION 7. — *(Photographs. — See fig. 15 to 21.)*

QUESTION 8. — *Which types do you prefer and for what reasons?*

The S. N. C. F. formerly had other types in service. Experience showed that the present types are those giving most satisfaction, both to clients and to the railway. These containers are suitable for all kinds of traffic. They are easy to handle, even in the restricted space often available at client's premises.

The small number of different types facilitates a good turnround. Their very robust construction reduces damage and maintenance.

In France, the types A and B are in the most demand.

The Netherlands Railways prefer containers of a capacity of about 1 m³ (35 cubic ft.) for the following reasons :

According to the tariffs for sundries, the

TABLE VI.

Characteristics of the small containers up to 3 m³

Type of container	Question 6a MATERIAL USED IN ITS CONSTRUCTION	6b Rigid or collapsible with or without wheels	6c Interior dimensions Length m	Width m	Height m	Capacity in m³	6d Maximum load in kg	Tare in kg	6e Cost of construction in 1951	6f Maintenance costs per annum	6g Average amortization period
	BELGIUM (S.N.C.B.) :								Belgian fr.	Belgian fr.	
9a	Pressed steel body. Removable floor and walls in 22 mm thick pine. Fixed wall and top in 10 mm thick multiplex.	Rigid with wheels	1.430	0.830	0.960	1.180	1 240	260	7 220	(1) 462	12 years
10a	As above but the multiplex is 12 mm thick.	Idem.	1.650	1.050	1.150	2.000	1 190	310	8 230	462	12 years
15	Pressed steel frame Inside lining of 6 mm triplex covered with No. 10 zinc. Outside covering : 6 mm xylotekt. 100 mm thick insulation of cork. Door in the side walls.	Idem	1.460	0.920	1.050	1.500	855	645	15 500	462	12 years
15a	Pressed steel frame. Inside lining : 1 mm aluminium. Outside covering : 10 mm multiplex. Top : 10 mm thick mattress filled with cork shavings. Insulating material : 102 mm of ONAZOTE.	Idem	1.415	0.875	1.135	1.400	1 050	450	21 500	462	12 years

									French fr.		
	FRANCE (S.N.C.F.) :										
A	Wooden body with metal framework with one removable side.	Rigid with wheels	1.450	0.800	0.920	1.000	1 230	270	76 730		not yet fixed (2)
B	Idem.	Idem.	1.650	0.950	1.320	2.000	1 175	325	86 550		
C	Metal frame with one removable side.	Idem.	1.900	1.100	1.420	3.000	1 150	350	100 000		
	NETHERLANDS (N.S.) :								H. fl.	H. fl.	
A	Metal body.	Rigid with wheels	1.498	0.980	1.100	1.500	1 000	270	900	45	10 years
	ITALY (F.S.) :									lires	
A	Steel chassis, metal body, half of the upper panel and one side wall can be opened.	Rigid with wheels	(3) 1.483	(3) 0.876	(3) 1.000	1.100	500	300	no purchase in 1951, supposed cost 700 l per kg of tare	15 000	20 years
A	Metal bodies turned into containers A on chassis at the time of the alteration.	Rigid with wheels	(3) 1.312	(3) 1.040	(3) 1.060	1.100	1 100	200	Idem.	Idem.	Idem.

(1) The maintenance and repair costs are on the average (taking one type and another) respectively 32 and 420 francs, i.e. a total of 452 Belgian francs. All the S.N.C.B. containers comply with the prescriptions of Note III of the U.I.C. The bodies are all completely covered in (covered type). They have a metal framework and wooden panels. Only the top is made of sheeting.

(2) The containers are re-made when the cost of repairs reaches or exceeds 60 % of the cost of a new container.

(3) Outside dimensions.

TABLE VI *(Continued)*.

Type of container	Question 6a MATERIAL USED IN ITS CONSTRUCTION	6b Rigid or collapsible with or without wheels	6c Interior dimensions Length m	Width m	Height m	Capacity in m^3	6d Maximum load in kg	Tare in kg	6e Cost of construction in 1951	6f Maintenance costs per annum	6g Average amortization period
	GERMANY (D.B.)								D. M.	D. M.	
A	Containers made of wood and iron.	Rigid with wheels	1.450	0.800	0.900	1.000	1 000	233	460	40-45	Amortization by means of an annuity of 6.3 %
B	Idem.	Idem.	1.650	0.950	1.300	2.000	1 000	295		Idem.	
C	Idem.	Idem.	1.900	1.100	1.425	3.000	750	328		Idem.	
	AUSTRIA (Oe.B.B.)								S	S.	
A	Closed body of wood with metal frame.	Rigid with wheels	1.450	0.800	0.900	1.000	1 000	260	5 000	50	9 years
B	Idem.	Idem.	1.650	0.950	1.300	2.000	1 000	310	5 500	Idem.	Idem.
C	Idem.	Idem.	1 900	1.100	1.420	3.000	1 000	330	7 500	Idem.	Idem.
	SWITZERLAND (C.I.T.)								frs.	frs.	
A	*a)* Chassis and frame of the body in iron, lattice body, with wooden sides, front and cover.	Rigid with wheels	1.400	0.800	0.900	1.000	1 000	200-250	1 000-1 100	25	15 years
B			1.900	0.800	1.300	2.000	1 000-1 100	280-300	1 200-1 300	Idem.	Idem.
C			1.900	1.100	1.425	3.000	1 000-1 100	400-450	no purchases in 1951	Idem.	Idem.
A	*b)* Chassis and frame of the body in iron, sides, front and	Idem.	1.400	0.800	0.900	1.000	1 000	160	Idem.	Idem.	Idem.

B	cover in galvanized iron sheeting.		1.900	0.800	1.300	2.000	1 000	350-380	Idem.	Idem.	Idem.
	ALGERIA (C.F.A.) :										
—	Metal chassis and body.	Idem.	1.900	1.100	1.420	3.000	1 125	375			—
	DENMARK (D.S.B.) :								Dan. cr.	Dan. cr.	
A	Frame of the body in steel covered with wooden planks, sheet steel covering.	Idem.	1.460	0.820		1.000	1 000	250	1 050	110	40 years
B	Idem.	Idem.	1.650	0.950		2.000	1 000	350	1 350	110	Idem.
	LUXEMBURG (S.N.C.L.) :									Belg. fr.	
A	Covered wooden containers 90 % of which have closed in and 10 % lattice walls.	Idem.	1.450	0.800	0.900	1.000	1 000	220-230	no recent purchases	500	not known
B	Idem.	Idem.	1.650	0.950	1.300	2.000	1 000	280-350	Idem.	500	Idem.
	PORTUGAL :									Escud.	
D	Iron sheeted containers.	Idem.	1.976	1.012	1.620	3.000	2 000	274	no recent purchases	3 000	not known
E	Wood ditto.	Idem.	1.950	0.966	1.620	3.000	2 000	520			
	SWEDEN (S.J.) :								Swed. cr.		
—	Wooden containers, iron sheeting or tube.	Rigid or collapsible with wheels	—	—	—	1.200 2.500	1 000 1 500	—	550-600	—	—
	CZEGHOSLOVAKIA (C.S.D.) :										
—	Wood or iron.	Rigid with wheels	—	-	—	up to 3.000	up to 1 200	350	—	—	—

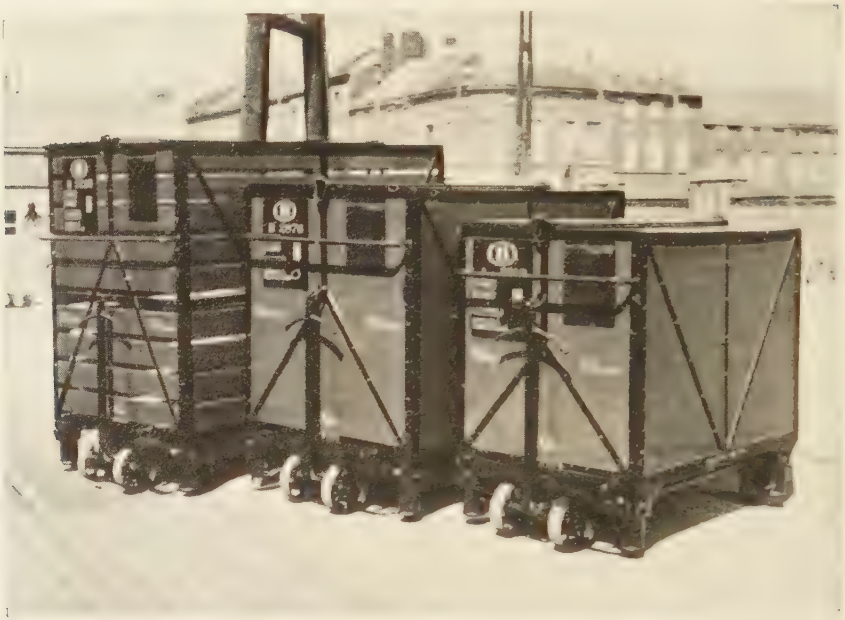


Fig. 15. — *Belgium*. Small containers A, B and C

Fig. 16. — *France*. Small containers of 1 m³, 2 m³ and 3 m³ (categories A, B and C). Fixing device down.

cost of transport from the station to client's premises is included in the usual transport charges. So it is desirable that the container should not be too large in order to facilitate handling on the lorries used for the terminal services.

The N. S. prefer collapsible containers in order to obtain better user of the wagon capacity on empty runs.

The F. S. state that clients prefer small containers of category A, 1.1 m³ as these are easy to handle. These containers are in particular demand for consigning fragile goods.

In Germany, the A category container (1 m³) is also much appreciated by clients. On the other hand, category C containers are not much liked at transhipment centres as they are more difficult to handle. The D. B. do not propose to increase the number of such containers.

The Oe. B.B. prefer closed containers to those with lattice walls; damage and theft is reduced thereby. This railway points out that the construction characteristics of containers are laid down in detail in Note 91 of the U. I. C., so that the Administrations cannot design new types at will.

Fig. 17. — *Netherlands.* Small container A of 1.5 m³.

In Switzerland, containers of categories A and B are preferred. These moreover are the only types hired out to clients, who find them very satisfactory. The position is the same in Luxemburg.

In Algeria, the types used have proved satisfactory.

In Denmark, the D. S. B. prefer to use

category B containers (2 m³ [70 cubic ft.]) but category A containers must also be available for use by clients.

The Portuguese Railways prefer metal containers, which are lighter than wooden ones.

In Sweden, the two types in use are satisfactory and are used according to the dictates of the traffic.

QUESTION 12. — *Do you experience any difficulties in storing containers in the stations?*

If so, what steps have you taken to remedy these difficulties?

(See table VII hereafter.)

QUESTION 13. — *What steps have you taken or do you consider advisable in order to reduce empty runnings to the minimum?*

Fig. 18. — *Italy.* Small container A of 1.1 m³.

QUESTION 9. — *What is the average turn-round (counted from the day they are loaded to the day they are loaded again)?*

QUESTION 10. — *What is the average distance they travel loaded?*

QUESTION 11. — *What is the percentage of empty runnings compared with the total distance they travel?*

In the opinion of the S. N. C. B., the best way of reducing empty runs is to have a central organization following up each container. This system is however only applicable when there are not a great number of containers.

TABLE VII.

Replies to questions 9 to 12.

RAILWAY	Question 9	Question 10	Question 11	Question 12
Belgium (S.N.C.B.)	7	—	—	no
France (S.N.C.F.)	10	350	(1) 20 (2) 15	(4) no
Netherlands (N.S.)	9	(1) 200 (2) 200 (3) 125	(1) 48.7 (2) 50 (3) 10	no
Italy (F.S.)	15	200	km loaded equal km empty	no
Germany (D.B.)	7	270	1 m^3 : 14.3 2 m^3 : 15.5 3 m^3 : 18.0	no
Austria (Oe.B.B.)	5	250	48	(5) yes
Switzerland (C.F.F.)	7.3	137	(1) 26 (2) 48	(4) no
Algeria (C.F.A.)	4	—	—	no
Denmark (D.S.B.)	not established	not established	—	(6) no
Spain (R.E.N.F.E.)	—	—	50 %	no
Luxemburg (S.N.C.L.)	(7) 4 (8) 11 (9) 22	(7) 46 (8) 257 (9) 485	40 %	no
Sweden (S.J.)	—	—	15-20 %	yes, trials in hand

(1) Railway owned containers.

(2) Privately owned containers.

(3) Pallets, box pallets.

(4) Greater demand for railway containers than can now be met.

(5) Warehousing difficulties due to war damage.

(6) Special authorisation required for their use at small stations.

(7) Internal services.

(8) Adjoining countries.

(9) Other countries.

In Belgium, where the stock of containers amounts to nearly 1800, the allocation method used is as follows :

— The railway is divided into areas depending upon a transhipment station.

— Unless a contrary order is received from the transhipment station or central distribution office, the stations always return containers in excess of their requirements to their area transhipment station.

— The transhipment station allocates containers within its area, according to a statement prepared by each station at a given hour, showing the containers available per different category, and those that will be required the next day.

— The central allocation office establishes equilibrium between the transhipment stations by ordering the movement of empty containers from those serving the areas where the greatest number are received towards those areas from which the greatest number are consigned.

In Holland, the geographical situation of the country makes it impossible to take any steps to reduce empty runs.

Fig. 19. — *Switzerland*. Small container B of light metal (2 m³). Tare : 245 kg. Fixing device up.

The S. N. C. F. state that in their case the allocation of railway containers has been studied in order to reduce to the minimum the empty runs. However, they did not give any details. Empty containers

owned by private firms are charged, so the owners themselves take steps to reduce empty runs to the minimum.

In Italy, if the empty mileage exceeds the loaded mileage, the excess is charged at the standard rates.

The Swiss C. F. F., before 1950, allocated the railway containers to certain stations to which they were sent as soon as unloaded. To reduce the number of empty runs, this system was given up and containers are now sent indiscriminately to those stations which

Fig. 20. - *Switzerland*. Small container A of 1 m³ with lattice body. Tare : 259 kg. Fixing device down.

In Germany and Austria, containers are used as required and empty runs are only necessary when containers have to be sent to pick up a load at another station. Such empty runs are kept down to the strict minimum.

have regular use for them and are particularly well situated for the allocation checked by a central office.

Privately owned containers are sent back to their original station by the consignee.

The result is that there are more empty runs than the railway likes.

In Portugal, containers are normally allocated to important traffic, so that they can be utilized satisfactorily in both directions.

QUESTION 14. — *What are the times allowed to load and to get back containers supplied empty to a consignor for him to load, or delivered loaded to a consignee?*

In Belgium, consignors and consignees are given one day to return the container loaded or empty. In certain cases, the S. N. C. B. has set up depots at the consigning factories to cope with immediate demands. These depots are set up by agreement and no fees are payable either by the railway or the client.

In Holland, France and Luxemburg, the time allowed is the same as in Belgium. In Sweden, on the other hand, not more than 9 hours at the most is allowed.

In view of the fact that the F. S. hire out their containers to firms and treat them as belonging to private firms, the problem of the time allowed for loading and unloading does not arise.

The Swiss C. F. F. give a time limit which expires at the time the goods depot closes the day after delivery. Sundays and holidays are not included in this period. If the container is going to be re-used, the time is increased by 24 hours.

In Denmark, the consignor also has to send the container to the departure station before closing time the day after the container has been put at his disposal. On the other hand, the consignee must return the container to the arrival station not later than 48 hours after he has been notified of its arrival.

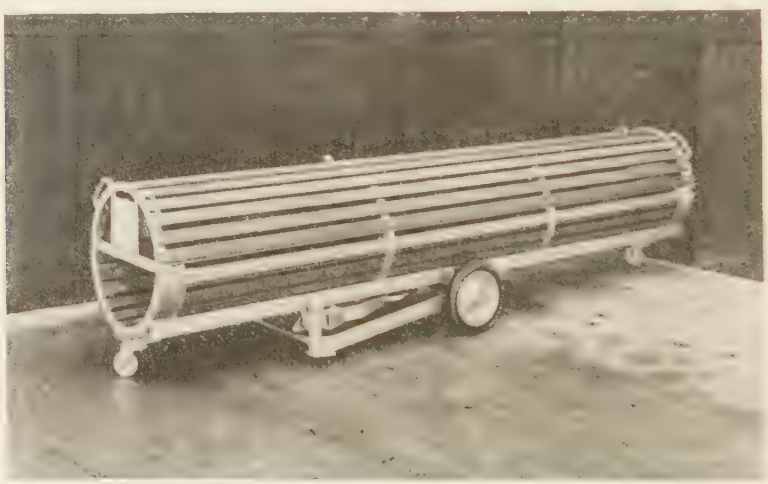


Fig. 21 — *Switzerland.* Special container for the transport of spools of raw viscose.

The German Federal Railways apply various time limits, as follows :

a) when the container is put at the client's disposal empty (1) :	*a)* it must be returned loaded at the latest :
— up to the 10th hour	— the same day before closing time.
— after the 10th hour	— the next day before closing time.
b) when the consignment is collected by the consignee or his agent :	*b)* the empty or reloaded container must be returned at the latest :
— if the period exempt from standing charges expires at midday or earlier	— the same day before closing time.
— if the period exempt from standing charges expires after midday	— the next day at midday.

If the consignment is handed over to the official haulier, the periods are as follows :

— delivered to the consignee before midday;	— the next day by midday;
— delivered to the consignée after midday;	— the next day before closing time.

QUESTION 15. — *Do you charge a hiring fee for containers belonging to the railway or affiliated Company?*

Does this cover the cost of purchase and sinking fund and maintenance charges?

The S. N. C. B. charge a fee for use over the whole of the journey in Belgium in the case of all containers as agreed, whether they are owned by the railway or private firms.

This charge *partially compensates* for the additional costs due to the use of containers (purchase, maintenance, empty runs, etc.). It varies according to the type of container (A. B. C.) and the distance (8 areas, the last being distances over 150 km = 91 miles).

In the case of international traffic, the supplementary fee is charged on containers belonging to the railways.

In Holland, the present hire charges for containers belonging to the railway does not cover costs. An increase is under consideration.

The S. N. C. F. charge for the use of their containers. The sum in question is a percentage of the transport charge, and decreases according to the distance (from 11 % up to 260 km [161 miles] to 3 % at 1 350 km [840 miles]). This more or less covers the amortization and maintenance costs.

In Italy, small containers are hired out at 40 lires a day. This fee does not appear to be sufficient to cover the cost of purchase, amortization and maintenance. But it is considered that traffic by means of containers (small and large) should be encouraged by a special rate.

In Germany, the hire charge exceeds the costs by about 50 %. The additional sum compensates for the transport of the container itself (tare), both when loaded and empty. As in Belgium, the charges vary according to the type of container and the distance (8 areas, the last being for distances over 1 000 km [620 miles]).

The Austrian Federal Railways charge for the use of containers, the sum varying according to the distance. It is based on the fact that the amortization of the containers takes place in 9 years.

All costs in connection with containers

(1) Made available at the station for the haulier or user's agent.

are calculated on the lowest possible basis, in order to recover railway traffic.

In Switzerland, the C. F. F. also charge a fee for use which varies according to the type of container (A and B) and the distance. This fee covers the costs. The tax is calculated according to areas (1 to 50, 51 to 100, 101 to 150, 151 to 200, 201 to 300 km, etc.).

The Algerian Railways do not charge any fees for the hire of their small containers.

In Denmark, the charges normally cover the costs. They are based on the distance (6 areas, the last being for all distances exceeding 500 km [310 miles]).

In Norway, Sweden and Czechoslovakia, the State Railways charge a hire fee according to the type of container and the distance (areas of 1 to 49, 50 to 99, 100-199, 200-299 km, etc.).

Portugal does not charge any hire fees at the present.

QUESTION 16. — *How are the transport rates calculated :*

a) *loaded;*

b) *empty?*

Belgium.

a) Small containers when *loaded* :

— usual charges according to the weight of goods carried, with a minimum of :

150 kg for A category containers from 1 to 1.2 m^3.

250 kg for B category containers of more than 1.2 to 2 m^3;

375 kg for C category containers of more than 2 to 3 m^3.

b) Small containers when *empty*

— containers belonging to the railway : free transport;

— privately owned containers of approved pattern : transport charge equal to the user charge.

Holland.

Small containers belonging to the railway *loaded.*

The weight on which the charges are based are fixed by multiplying by 0.2 the capacity of the container in dm^3; however the real weight of the consignment is taken into account if this is more than the weight calculated according to the capacity. By real weight is meant :

a) the net weight of the goods in the container, if this weight and the weight of the container itself are given separately in the consignment note;

b) the weight of the container and the goods together, if their respective weights are not given separately.

Charges when *empty* : carried free of charge.

Small privately owned containers.

In the case of *loaded* containers, the conditions are the same as for railway owned containers.

As for transport when *empty*, this is charged on the same lines as ordinary empties.

France.

S. N. C. F. containers .

a) *Loaded :*

Charged on the weight of the contents, with a minimum of 200 kg per container;

b) *Empty :* carried free.

Private containers :

a) *Loaded*

Charged according to the weight of the container with a minimum of 200 kg per container, and the application of reduced charges, the reduction being less and less according to the distance (the amount of the reduction is the same as the supplement charged for the use of S. N. C. F. containers) ;

b) *Empty :*

Charged according to the tare of the container.

Italy.

Loaded charged according to the net weight of the contents, and no charge for *empty* runs provided the mileage does not exceed the loaded mileage.

No minimum weights laid down for consignments in containers.

Germany.

a) *Loaded :*

Charged on the weight of the contents, including the weight of any loose devices used to hold or pack the goods in the container.

Minimum weight :

Containers	A	100 kg
»	B	250 kg
»	C	375 kg

b) *Empty :*

The transport of the container when empty is the affair of the railway, which does not make any charge.

Austria.

In the case of railway owned containers, the method of taxation is the same as in Germany, but the minimum weight laid down differs, viz :

Containers	A	200 kg
»	A	200 kg
»	C	500 kg

In the case of goods carried in privately owned containers, the charges are based on the total weight of the container and the goods (gross weight).

Switzerland.

a) *Loaded :*

Railway or privately owned containers : charged on the weight of the contents (tare of the container excluded).

Minimum weights :

Containers	A	130 kg
»	B	250 kg
»	C	380 kg

In the case of special containers fitted with heavy internal equipment (apart from refrigerator containers and tanks), i.e. those whose tare exceeds 320, 400 and 500 kg respectively for the three categories A, B and C, the minimum weight is increased by 100 kg.

As for refrigerator containers and tanks, the minimum weight of the consignment for taxation purposes is double the minimum laid down for ordinary containers. The only exception is refrigerator containers up to 0.5 m^3 (18 cubic ft.) capacity, whose minimum weight per container is limited to 130 kg.

Straw, wood shavings, and all other packing materials used in a loaded privately owned container are transported free when the container is returned up to :

Containers	A	30 kg
»	B	40 kg
»	C	50 kg

b) *Empty :*

— railway containers : carried free;

— privately owned containers, slow goods : transported free, on condition this is after they have been carried loaded by rail, or are going to be sent loaded by rail. If one of these conditions is not fulfilled : charged according to the actual weight, which is also the rule if the containers are sent « grande vitesse » (part loads).

Algeria.

a) *Loaded :*

Charged on the weight of the goods : minimum 200 kg.

If special devices are used to pack or fasten the goods, the weight of these is added to the weight of the contents;

b) *Empty :*

Railway containers : carried free.

Privately owned containers : charged according to the tare.

Denmark.

a) The transport charge is calculated

according to the weight of the contents : minimum 350 kg;

b) *Empty* containers belonging to the railway are carried free.

Spain.

a) *Loaded :*

The tare is carried free. If the actual tare exceeds the free amount, the surplus is considered as goods to which the normal charges apply;

b) *Empty :*

A very low scale is applied according to the tare and the distance.

Greece.

a) *Loaded :*

The tare of railway containers is free, but the charge for the goods is increased by 5 %;

b) *Empty :* no charge.

a) *Privately owned containers, loaded :*

The tare is free provided it does not exceed 650 kg plus 50 kg per cubic metre;

b) *Empty*, these containers pay the usual rates.

Morocco.

Railway containers.

a) *Loaded :*

According to the weight of the contents. Minimum 175 kg per m³ and 1 500 kg per wagon used for the same consignment;

b) *Empty :* carried free.

Privately owned containers :

a) *Loaded :*

As for railway containers;

b) *Empty :*

Taxed according to the unit weight and a given scale of distances.

Luxemburg.

a) *Loaded containers :*

Charged on the weight of the contents. Minimum weights :

Containers	A	150 kg
»	B	250 kg
»	C	500 kg

Privately owned containers of other than approved types are considered as packings and charged according to the goods they hold;

b) *Empty containers :*

— belonging to the railway. Carried free;

— privately owned, are charged at reduced rates of 50 %, but if sent as full loads, the rates applicable to empty packings in this case apply.

Norway.

a) *Loaded containers :*

Charged on the weight of the contents. Minimum weights :

Containers	A	200 kg
»	B	300 kg
»	C	500 kg

b) *Empty containers* are carried free.

Portugal.

a) *Loaded containers :*

Charged on the weight of the contents. The weight on which the charge is based must not be lower than 800 kg per cubic metre however of the stated capacity of the container and the weight deducted for the tare must not exceed 200 kg per cubic metre;

b) *Empty containers :*

The tare given on the container is the basis of the charge; express goods, the rates applying to packings are charged, and slow goods, a reduction of 50 % is granted.

Sweden.

a) *Loaded*

Weight of the contents : minimum 150 kg and 3/4 of the volume of the container;

b) *Empty*

As for returned empties.

Czechoslovakia.

a) *Loaded :*

Weight of the contents : minimum :

Containers	A	150 kg
»	B	250 kg
»	C	500 kg

b) No details given about charges for empty containers.

QUESTION 17. — *How are the haulage rates calculated :*

a) *for loaded containers;*

b) *for empty containers ?*

Belgium.

a) The charges are calculated from the net weight of the goods, taking into account the minimum weights given in the reply to question 16;

b) *Railway containers :*

A fee is charged according to the type of container (A, B and C).

Privately owned containers of approved types :

Charged according to the tare of the container.

Holland.

Containers belonging to the railway can only be sent to certain stations. Containers can only be carted at these stations, whether loaded or empty. The haulage charges are based on the average costs.

France.

a) *Collecting loaded containers from consignors premises :*

Fixed charge per 100 kg gross weight : minimum 200 kg per container.

This charge includes taking the empty container to consignor's premises from the station;

b) *Delivery of loaded container to consignee's premises :*

Free. The rates include the delivery charges.

Empty S. N. C. F. containers are collected free of charge from the consignee's premises.

Italy.

The user pays all the charges.

Germany.

a) The charges are based on the gross weight of the container. Minimum 500 kg.

In order to pay for the time lost in loading and unloading a supplement of 1 D.M. for the first half hour is added to the haulage charges. If the delay is prolonged, the costs are charged according to local usage;

b) Delivering or collecting empty containers belonging to the railway is free.

Austria.

a) The charges are based on the gross weight;

b) As in the case of bulky goods, i. e. with a supplement of 50 %.

Czechoslovakia.

The charges are based on the minimum for the weight applying to slow goods transported by rail.

Sweden.

a) According to the gross weight and distance;

b) The charges are reduced if the container is returned immediately on being delivered loaded.

Norway.

Same charges as for other goods.

Denmark.

The costs are not calculated directly by the railway; they are fixed in each case by agreement between the client and the haulier.

Luxemburg.

a) According to the gross weight;

b) According to the tare less 50 %.

Algeria and Morocco.

The charges are agreed between the haulier and the client, taking into account :

— the conditions under which the services operate in each locality;

— competitive prices;

— rates fixed by the Administration.

Switzerland.

a) On both arrival and departure, the official haulage rates are based on the gross weight;

b) On condition the transport when loaded has been carried out or will be carried out by the official haulier, the rates are based on half the weight.

* * *

B. — *Pallets.*

The replies to our questionnaire showed the great advantage of using pallets. However, the experimental stage is barely passed on those railways, which have decided to make use of them.

In this connection, it appears advisable to recall that the problem of the choice of methods for assuring door to door transport of small consignments *in the quickest possible time* has already been the subject of several investigations by the Congress. For example at the Cairo Session, in 1933, a similar study was made.

With the object of solving the problem of the rapid transport of parcels, already at that time, everything was being done to get as close as possible to the ideal solution which consists of collecting parcels at the premises of the consignor and transporting them economically, quickly and *directly* to the premises of the consignee. It was pointed out at that time that in order to reduce the cost of purchasing handling equipment, there was a great advantage in being able to separate the body of the truck from the wheels, or in other words make use of simple platforms and hand or electric trucks which could be put under these platforms, raise them up and transport them rapidly from one end of the depot to the other or from one wagon to another. But at the time, the only such device under consideration was a platform resting on four feet or on rollers and *merely* used inside the goods depots, where at the present time one railway after the other is considering the use of standardized pallets, which travel with the grouped lots of goods from one end of the journey to the other as far as possible.

Although the principle of transporting goods on pallets has been the subject of study over many years, as we have just seen, it is only recently that their use has been developed to an encouraging extent, and is even becoming the general practice on some European railways. Although in several countries, the experimental stage has barely been passed, it is possible nevertheless to see in their rapid growth an augery for the successful future of this method.

Those railways which have already had some experience in this field and have thousands of pallets in use are unanimous in their praise for the method and the advantages derived therefrom, and the Administrations, which have just begun to use them, are of the opinion that important economies in handling costs can be obtained by the introduction of this method, especially when the parcels have to be transhipped several times during the journey.

The use of pallets at every link of the transport chain is not however always effective unless they are standardized, for the following reasons :

1) The pallets must be able to be used at different localities by means of standardized hand operated fork-lift trucks or standardized fork-lift tractors;

2) The pallets should have suitable dimensions, to make full use of the loading area of the wagons and lorries;

3) To facilitate, at a later stage in the evolution, the exchange of pallets between the different terminal establishments (pro-

duction plant, depots, warehouse, etc.), which will make use of the same method themselves, it is obviously necessary to standardize these pallets right away.

The International Railway Union, being anxious to encourage such standardization, recently published some clauses laying down the characteristics and methods of using loading pallets for international traffic.

The putting into service of standardized pallets and fork-lift trucks or tractors has undoubtedly opened up new perspectives for the rapid and economical handling of parcels and will certainly lead to modifications and further improvements in the door to door services.

However, the full value of the use of pallets can only be obtained when it is possible to transport most of the parcels from door to door on the same pallets, just as is done in the case of containers.

The use of pallets from one end to the other greatly simplifies handling. This method should be judged according to its

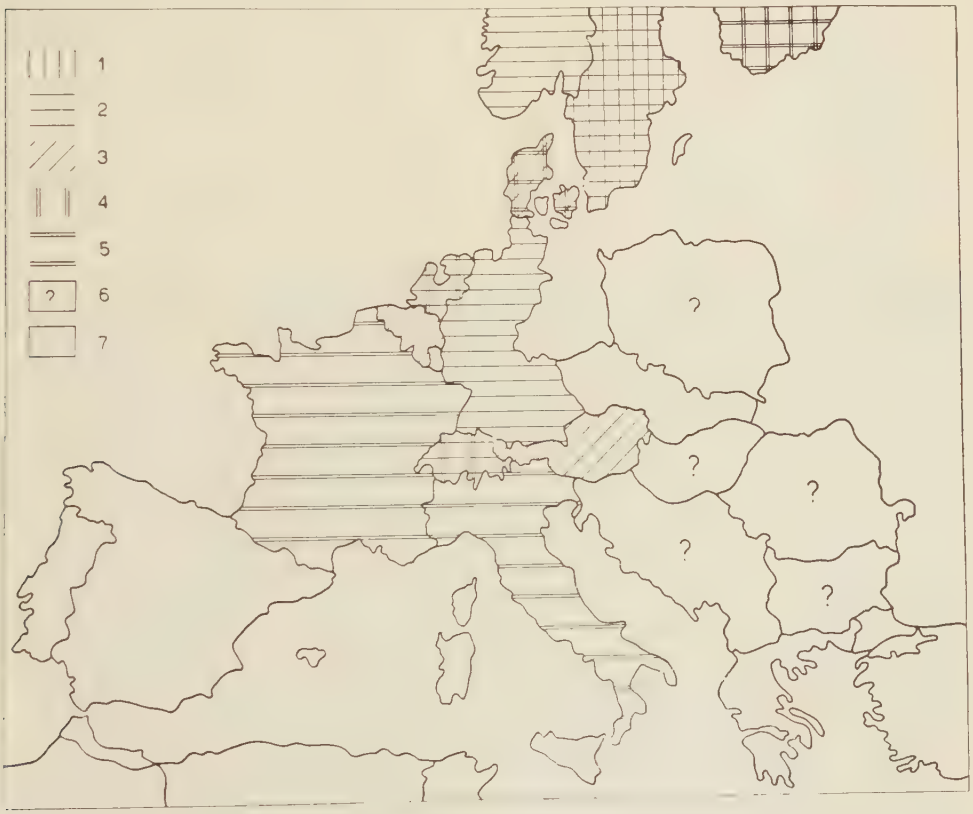


Fig. 22. — Synoptic map showing the development of the use of pallets.

Explanation:

1) U. I. C. pallets in use for door to door services.
2) U. I. C. pallets in use on the railway's internal services.
3) Other pallets in use on the railway's internal services.
4) Door to door services using U. I. C. pallets under study.
5) Introduction of U. I. C. pallets in the railway's internal services under study.
6) Railways which did not reply.
7) Railways which do not use pallets.

possibilities, which can be summed up as following, taking the order in which handling operations occur :

— facility of transport during manufacture

— on leaving the factory or other premises, the parcels are put on pallets

— the loaded pallets are taken by means of fork-lift trucks or tractors to the depot where they are stored;

— if the parcels are sent off direct from the depot, they are loaded onto the lorries on the pallets;

— the lorry takes the loaded pallets to the goods depot;

— a railway fork-lift tractor takes the loaded pallets to the weighbridge, leaves them on it if necessary, picks them up after they have been weighed and takes them to the wagon;

— at the destination station, a railway fork-lift tractor takes the loaded pallet off the wagon, leaves it in the goods depot or loads it directly onto the lorry (belonging to the consignee or to a haulier) ;

— the consignee, also by means of a fork-lift truck or tractor, takes the loaded pallet into his premises, where he can leave the parcels on the pallet until they are wanted.

* * *

In Sweden, the beginning of palletization goes back to 1946. Owing to the high cost and shortage of labour (1), the Swedish Railways were very interested in reducing the manual operations in the goods depots, especially as the methods used to date — trucks and barrows — were relatively heavy. This Administration consequently made great efforts to speed up palletization. They encouraged business and industrial firms to equip themselves in the same way. The results appear to have been satisfactory.

At the end of May 1951, out of about 2 000 stations on the Swedish Railways, 50 goods depots (2 1/2 %) were equipped to handle the parcels traffic by means of this method.

The services in question then had 111 fork-lift tractors, 109 with benzine engines and 2 electric, and 450 hand operated fork-lift trucks. The most important centres were already equipped, the small percentage in question not giving a true picture of the exact degree of development, as the tonnage dealt with in these large centres represents a very considerable part of the total tonnage. We are not able to give the exact percentage as the Swedish Railways only gave the number of consignments and number of wagons loaded and unloaded.

The Swiss Commission, charged in June 1951, with studying the Swedish methods of using pallets, found that pallets are not yet widely used for the transport of goods between stations, but are used above all for handling them in the goods depots. They are chiefly used at the present time for the transport of parcels between the point at which these are handed in and the place where the wagons to be loaded are standing, or inversely between the wagons waiting to be unloaded and the goods depots. The restricted use of pallets between stations is due to various reasons, such as a shortage of pallets, the necessity for stacking goods right up to the roofs of wagons, and also certain difficulties in connection with the terms on which staff are engaged.

In an enquiry carried out at 11 stations, it was found that palletization made it possible to reduce the number of working days by 12 %.

In spite of the difficulties in the way of the regular and intensive use of pallets on the wagons, it can be said that the method has successfully passed its trials and that it contributes towards speeding up the work and lowering the cost of handling.

To determine the output, the Swedish Railways made trials in these depots of four methods of transhipment, involving 1 000

(1) In Sweden the working day of a labourer is only 7 h.

consignments of the same size over a distance of 50 m.

Labour costs were taken as 2.5 crowns the hour and the cost of the fork-lift tractor (excluding the wages of the operator) was 3.5 crowns an hour.

The table hereafter gives a summary of the costs of each of these methods, and brings out very strikingly the advantages of handing in to the railway goods loaded onto pallets.

The results obtained with the method

SYSTEM	Wages in crowns	Cost of tractor in crowns	Total cost in crowns
1. Sack truck	37.—	—	37.—
2. Low loading goods truck	29.25	—	29.25
3. Fork-lift tractor (goods not loaded onto pallets when handed in)	16.—	4.90	20.90
4. Fork-lift tractor with pallets (the goods being loaded onto pallets when handed in)	3.50	4.90	8.40

Fig. 23. — *Denmark.* Loading goods with pallets and fork-lift tractors.

Fig. 24. — *Netherlands.* Fork-lift tractor handling two box-pallets together in a goods depot.

Fig. 25. — *Belgium.* Fork-lift tractor superposing box-pallets in a goods depot.

shown under 4, show very strikingly that the railway, as well as its clients, has every interest in seeing that everything is done to encourage the general use of pallets in order to reduce to the greatest possible measure repeated handling which is one of the most frequent causes of damage in the chain of terminal transport.

In Sweden, although the goods sent by rail are generally speaking very well packed, as most consignments are sent in cases or cartons, it is nonetheless true that there is just as great a diversity of parcels as in other countries. This does not prevent the widespread use of pallets.

In Denmark, the beginnings of palletization date back to 1948.

In May 1951, this country had 2 000 pallets in use and 18 fork-lift tractors distributed amongst 6 stations. In the meantime other station depots, in particular the slow goods depot at Copenhagen, have been equipped with pallets and fork-lift tractors.

The Danish Railways use a type of pallet (1 000 × 1 000 mm) which is slightly different from the U. I. C. type (1 215 ± 5 × 810 ± 5 mm), but they are considering adopting the standard type.

In this country, pallets were used up to the summer of 1951, solely to handle goods in the goods depots. It was not until the new machines were put into service in the large slow goods depot at Copenhagen that the possibility of sending loaded pallets from one station to another could be considered (see fig. 23-25).

In Holland, the pallets and box-pallets are owned by an (1) affiliated Company of the Railway (Van Gend and Loos). They are used exclusively for internal transport in the goods depots, except in exceptional cases when they are put at the disposal of clients to be loaded at their premises.

(1) Characteristics of the Dutch box-pallets : made of iron sections with wood lining. In order to facilitate loading one of the long sides is shaped like an open V. No wheels nor cover.

The fork-lift tractors are owned by the same firm.

Palletization is complete at four stations. Five other centres also use fork-lift tractors as a general practice. A total of 25 fork-lift tractors were in service when the reply to our questionnaire was sent in (December 1951).

The Netherlands Railways sum up the advantages of palletization as follows :

a) increased speed of working;

b) less damage, the handling of standardized loads reducing the frequent handling of single consignments;

c) the use made of the available space in the wagon is sometime better, as fragile parcels can be stacked higher thanks to the use of superimposed box-pallets. However, in some cases, the use is reduced owing to the space taken up by the pallet itself. However, this drawback is in fact merely theoretical as wagons are mostly only partly full to most destinations (1);

d) palletization has made it possible to increase the tonnage handled per man-hour by 50 % (all kinds of parcels). In one of the four stations so equipped for example, the weight handled per man/hour has increased to such an extent as to make possible a 33 % reduction in labour.

In spite of these promising beginnings, palletization in Holland is still in the experimental stage, and the figures given are only provisional. Consequently the affiliated company did not think it advisable to give detailed figures about the costs and the savings obtained.

The trials are being actively pursued. The objects of the Netherlands Administration are as follows :

— to transfer the accent on mechanization by switching it over from mixed small

(1) According to the latest information received, the extension of the use of pallets has not involved the use of a greater number of wagons for the parcels traffic. The average load per pallet is 275 kg. As a wagon can take 32 standardized pallets, 8 800 kg can be dealt with in this way. The average load of the wagons used for this traffic does not exceed 4 000 kg however.

consignments to larger lots of symmetrical parcels;

to have small consignments loaded at the client's premises (though box-pallets should not take the place of packing, as this would make handling in stations not so equipped very difficult);

to purchase electric machines;

to give special responsibility to a certain number of employees, according to the duties they have to carry out.

After this has been done, the Netherlands will carry out a new analysis of the problem of using pallets in order to determine more exactly the cost and the savings obtained.

The Swiss Federal Railways began trials of pallets last year, the pallets in question being the property of the Administration. Three large stations are now being completely equipped. The trials were very satisfactory. Once these three stations have been equipped, it would appear that a 7 to 8 % saving in labour will be possible.

Other stations will be equipped by gradual degrees with the necessary handling equipment, in order to extend the experiment and thus make it possible to ascertain the costs on a solid basis.

In Switzerland, the pallets are carried by means of fork-lift tractors equipped with electric batteries, petrol tractors and hand elevator trucks (mechanical and hydraulic). Originally, the C. F. F. thought of using only electric machines, but they found that petrol machines were also very good and should be given a trial.

In Germany, palletization trials began in 1951 as in Switzerland (Herford station). Soon after this system was introduced, the station staff as a result could be reduced from 90 to 78. Later, it was found that in addition the number of accidents during handling and damage to goods had decreased to a very marked extent. Finally, clients noted a considerable speeding up in delivering goods, which was greatly appreciated.

At Herford, the trials began with 5 petrol driven fork-lift tractors and one tractor equipped with electric batteries. The petrol machines are much faster, both for starting up and for running about the goods depots.

In Italy, the use of pallets is being studied, and trials will first of all be made at Genoa.

In Belgium, the S. N. C. B. use box-pallets owned by them for grouping small consignments (see fig. 25). In principle,

Fig. 26. — *France*. Fork-lift tractor of French make, on trial.

these are loaded on acceptation of the consignments and the goods are not handled again until they reach their destination, even if several transhipments have to take place en route.

In France, pallets and box-pallets are not yet in current use on the S. N. C. F. Their use is only in the preliminary stage for trial and study purposes (see fig. 26).

The Austrian Federal Railways have in use special loading platforms (see the following chapter C).

Table VIII hereafter gives particulars of fixed and variable costs relating to the handling of goods by means of pallets and fork-lift trucks.

C. — *Other machines.*

In most countries, the most usual machines used for handling goods at the station are, apart from sack trucks, various types of goods trucks (flat trucks hauled or pushed by hand, low goods trucks pulled by hand or the classic type of platform trolley, etc.) In Switzerland, for example, the 8 or 6 wheeled goods trucks can be fitted with removable frames to carry cast iron or pottery goods from door to door.

In Belgium, in addition to the box-pallets and fork-lift trucks already mentioned, the following are used for the handling of small consignments :

at the goods depots :

— three-wheeled trucks (maximum load : 1 500 kg);
— barrows;
— low-loader trucks with two or six wheels for heavy goods (maximum load : 1 000 kg);
— electric tractors (traction at the drawbar : 150 and 300 kg);
— electric carrying trucks (maximum load : 3 000 kg);
— two-wheeled trolleys (maximum load : 500 or 1 500 kg);
— luggage trolleys.

for door to door transport :

— motor vans of 800 to 1 500 kg;
— 2 to 4 t motor lorries; some of these are equipped with special gear to unload small containers, or a « lift-gate » device for heavy consignments;
— motor tractors with trailers;
— trailers for motor lorries.

Cost of three-wheelers : 3 500 to 4 000 Belgian francs.

Cost of electric tractors, 1 engine : 125 000 fr.

Cost of electric tractors, 2 engines : 225 000 fr.

Cost of electric carrying trucks: 150 000 fr.

Cost of elevator trucks with platforms : 200 000 fr.

Generally, the S. N. C. B. prefer the electric machines, which are more economic from the point of view of consumption or maintenance.

Until recently, the S. N. C. B. used mostly three wheeled trucks in stations where the traffic amounted to any considerable amount. These are left loaded as long as possible. This avoids intermediate handling, the chief source of damage and time lost. They are therefore like some mobile store boxes.

The S. N. C. F. state that, apart from containers and pallets, they have practically no machines for dealing with the door to door transport of small consignments.

To handle these goods at the stations, they make use of flat trucks or four wheeled trucks for carrying several pallets over a certain distance (more than 100 m), which can be hauled by the platform trolleys (fig. 27 and 28).

As for handling the consignments and parcels at the consignor's premises, this is usually done by hand.

Mention must be made however of cranes mounted on road vehicles for collecting and delivering small containers up to 1 500 kg at client's premises where there is no loading platform. These cranes can be turned by hand over 360°. They can be fitted with an automatic or hand operated hoist, or a hand operated pulley-block.

TABLE VIII.

Factors used to calculate the cost of handling by means of pallets and box-pallets.

PALLETS FIXED COSTS	Unit	*Austria Ö.B.B.*	*Belgium S.N.C.B.*	*Denmark D.S.B.*	*France S.N.C.F.*	*Holland N.S.*	*Sweden S.J.*	*Switzer. C.F.F.*
	Currency	Sb.	Fr.	Kr.	Fr.	Fl.	Kr.	Fr.
PURCHASE PRICE :								
Mechanical hand lift . . . . . 1 000 kg	—	5 000		1 440 (1)	50 000		(2) —	6-700
Hydraulic hand lift . . . . . »	—	—	—	—	—	—	—	8-900
Hand elevator . . . . . »	—	—	—	—	275 000	—	—	—
Motor elevator :				(1)				
Petrol motor elevator . . . »	—	—	150 000	16-25 000	1.2 mio	13 500	15 300	17-20 000
Electric motor elevator :								
frame . . . . . »	—	—	200 000	—	2.5 mio	—	—	18-22 000
plus batteries :	—	—		—		—	—	
a) alcaline . . . . . 2 jeux	—	—	—	—	—	—	—	16-19 000
b) lead . . . . . »	—	—	—	—	—	—	—	6-7 000
plus charging plant	—	—	—	—	—	—	—	3-4 000
Pallets	—	300	—	17 (1)	—	28	—	16
Box-pallets	—	—	—	—	—	135	—	—
EXPECTED LIFE								
Hand elevator	years	8-10	illim.	—	5-10	—	—	15
Petrol motor elevator	years	—	5-8	—	—	4-8	8	8-10
	hours					15-25 000h	20 000 h	
Electric motor elevator . . .	years		10-15	—	10-15	—	—	10-12
Batteries :								
a) alcaline	»	—	4	—	—	—	—	6-7
b) lead	»							2-3
charging plant	»							(3)
Pallets	»	8-10	—	—	—	—	—	1-2
AMORTIZATION PERIOD								
Hand elevator	years	10	10	—	—	—	—	—
Petrol motor elevator	»	—	5	—	5	4	—	—
Electric motor elevator	»	—	10	—	—	—	—	—
Pallets	»	10	—	—	—	4	—	—
Box-pallets	»	—	—	—	—	8	—	—
AMORTIZATION								
Elevators	%	10	—	(4) 25	—	—	—	—

Cost of materials :									
As a percentage of purchase price : elevator	%	—	3	—	—	5	—	—
Cost of labour :									
As a percentage of hours	—	—	20	—	—	12.5	—	—
Total costs :									
As a percentage of purchase price :									
Pallets	%	—	—	—	—	15	—	—
Box-pallets	%	—	—	11	—	2	—	—
Tractors	%	—	—	—	—	—	—	5-10 %
Per hour :									
Elevator : total currency	currency	—	—	—	150 fr.	—	1.45 Kr.	—
per repair	»	—	—	—	—	—	0.90 Kr.	—
per overhaul	»	—	—	—	—	—	0.55 Kr.	—
Garage, per hour	»	—	—	—	—	—	0.06 Kr.	—
VARIABLE COSTS :									
Labour :									
Hand elevator up to 600 kg	men	1	—	—	1-2	—	—	1
Hand elevator above 600 kg	»		—	—		—	—	2
Motor elevator	—	—	—	—	1	—	—	1
Speed :									
Petrol elevator	kmh	—	7	—	10-16	—	—	13
Electric elevator	—	2.4	5-7	—		—	—	9-10
Fuel :									
Petrol : per hour	litres	—	1.9	—	3	1.8	1.3-1.5	1.5-2
per machine/per annum	Kr.	—	—	1 300 (1)	—	—	—	—
per machine/per hour	»	—	—	—	—	—	0.75	—
Electric power :									
KWh	—	—	2	—	1	—	—	1.4
Lubricant :									
Per hour	litres	—	0.05	—	—	0.007	—	—
Per hour	Kr.	—	—	—	—	—	0.10	10 % of fuel
Per year	»	—	—	330 (1)	—	—	—	—
Total cost of operating the pick up elevators per hour	Kr.	—	—	—	—	—	3.26 Kr.	—

(1) Information collected by an Investigation Commission appointed by the Swiss Federal Railways.
(2) Information supplied in 1951 by the S.J. Organisation Service.
(3) 10 years for 1/3 of the stock, 30 years for the remainder.
(4) Interest included.

Fig. 27. — *France.* Three-wheeled electric battery tractor and trailer. Motor type series 2.5 HP continuous rating, 5 HP hourly rating. The tractor is fitted with a guiding device to put under the platform, a lifting device to raise the platform up and a locking device when same is in the highest position.

Fig. 28. — *France.* Three-wheeled tractor and trailer 4 HP, 2 cylinder petrol motor. Speed : 15 to 20 km/h on levelled concrete floor. The trailer is coupled on and locked automatically.

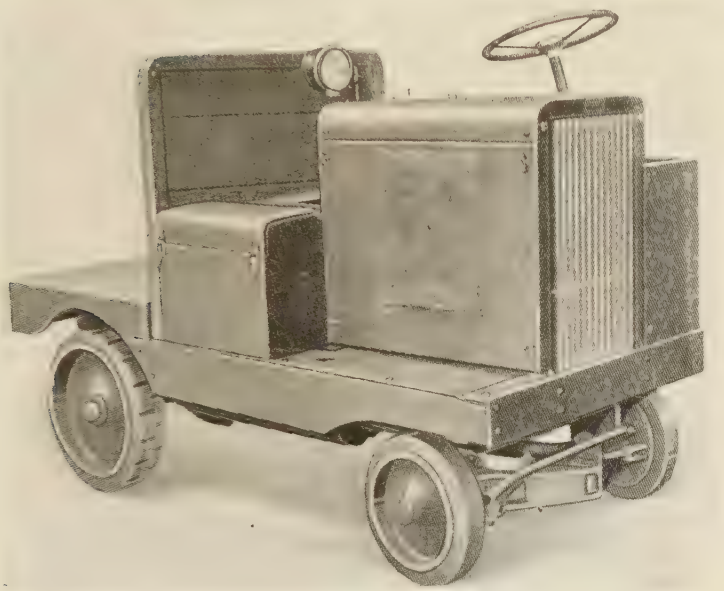


Fig. 29. — *Denmark*. Petrol tractor.

The tractor is chiefly used for the transport of luggage trolleys; it has a small platform on which goods can be loaded.

The four cylinder, water-cooled, 40 HP engine is fitted with an automatic starter and electric ignition.

The frame is made of strong iron sections.

There is a special control device so that the tractor can turn on a 4 m wide track.

The wheels are fitted with heavy solid rubber tyres.

The capacity of the fuel tank is about 20 l.

The maximum speed is 30 km.

It weighs 1 300 kg.

The drawbar pull is about 500 kg maximum.

The tractor is very easy to operate.

They have a 1.5 m reach. The arm folds back. Only one man is needed to hook on the container, put in the clutch on the lorry, lift the container, move it over and let it come down. Time needed : 10 to 15 minutes.

The cost of a crane of this type is 350 000 French fr. plus 40 000 fr. for fitting it on the lorry.

In Germany and Switzerland, small containers are usually taken to client's premises on specially arranged low loading trailers.

The Austrian Railways use loading platforms to group together the parcels from one and the same consignor. The machine, which differs from the U. I. C. pallets, can take a load of 2 t; they are transported by means of elevator-tractors. The goods which cannot be handled in this way are placed on 4-wheeled goods trucks and

pulled by hand or by electric trolleys, unless they are transported by means of sack trucks. All these machines are used by the railway only and are not used for taking goods to client's premises.

This Administraiton has determined as follows the difference in output between an electric trolley with its driver and a goods truck with four pneumatic tyred wheels and roller bearings accompanied by two men.

Electric trolley :

Speed of the trolley . . 160 m/min = 10 km;
Time taken for the run . . . . . 26 % = 2.2 h;
Time taken to load and unload. . 65 % 5.6 h;
Time lost . . . . . 9 % = 0.8 h.

Journey :

There and back $= 2 \times 320 = \frac{640}{160} = 4$ min;

2.2 hours $= \frac{132}{4} = 33$ runs.

LORRY LIFTING DEVICE.

Fig. 30. — *Switzerland.* 3 t lorry fitted with « Giroud-Olten » 1 t lifting gear enabling loads to be picked up 2.55 m away from the vehicle and set down anywhere on the lorry. Hydraulic operation of the crane; manual operation of the hoist.

Bases. — Useful load of one ton transported over a level smooth path for a distance of 320 m. i. e. 640 m there and back; coefficient of resistance and inertia R 20 kg per tonne.

Cost of operating an electric trolley : 15.5 S an hour:

Cost of operating a goods trucks : 10.5 S an hour.

Goods truck pulled by hand :

Speed of the truck . . . 40 m/min = 2.4 km;
Time taken for the run. . . . . 48 % 4.1 h;
Time taken to load and unload. . 43 % = 3.7 h;
Time lost . . . . . 9 % = 0.8 h.

Journey :

There and back $= 2 \times 320 = \frac{640}{40} = 16$ min;

4.1 hours $= \frac{246}{16} = 15$ runs.

If the manually operated goods truck is to do the same amount of work as an electric trolley, it is necessary to spend : 33/15 = 2.2 × 10.5 = 23 S an hour, whereas the electric trolley costs 15.5 S. If the latter can pull one or several trailers as necessary or if the path is not very good, the advantages obtained from its use are still more marked.

SUMMARY.

FIRST PART.

Door to door services.

1. *Private sidings.*

If, in general, the railways were unanimous in recognising the need to facilitate to the greatest possible extent the development of private sidings, the solutions considered or applied for this purpose differ considerably from one railway to another (1). The general rules applied by the different railways can be summed up as follows :

a) Participation in the construction costs of the siding by :

— gratuity or rebate on the work done by the railway (studies, supplying material for the siding, and labour for its construction) ;

— hiring out material for the siding;

— supplying material on credit for a certain number of years;

— electrification of part of the line, if necessary in the station precincts;

b) Reducing the cost of operating such a siding by :

— rebates on the cost of shunting or maintenance;

— partial reimbursement of the operating costs according to the amount of traffic;

c) Tariff reductions. Here the methods vary a great deal. There is for example :

— a reduction in the minimum rating distance;

— the fixed rate for the first 50 km is turned into a proportional rate;

— traffic premiums in the form of a rebate per ton or wagon sent;

— special prices, i. e. reduced transport taxes.

A few Administrations are opposed to any reduction in the rates, either because of the additional cost of shunting wagons onto these sidings, or because they consider this is unfair to other clients.

Certain railways consider that the mere fact that there is a private siding, coupled if need be with a fidelity cause in the contract, is a sufficient guarantee against road competition. Finally, other Administrations have the impression that the granting of reductions proportional to the amount of traffic is of greater value in the long run.

The summaries of the Rome Congress (1950) regarding private sidings consequently have lost nothing of their value. The Administrations stress the importance of such installations and the information they give about the percentage of traffic show very clearly that private sidings are an effective way of fighting competition. Their systematic development should therefore remain in the forefront of railway préoccupation and it is important that the Administrations should devote a great deal of attention to the construction of such sidings and in particular the lines giving access to them which very definitely are feeder lines.

2. *Station depots.*

The Administrations are also doing everything possible to encourage the setting up of depots by clients at stations; some of them even grant very considerable reductions in the sums due from those concerned. Although bringing up the wagons in most cases increases the amount of shunting to

(1) This diversity of methods led the International Railway Union to publish, in January 1952, a note giving a résumé of the rules generally applied for the construction and operation of private sidings.

be done as it is necessary to serve such depots at certain given hours — the position is the same moreover in the case of private sidings — the railway has the greatest interest in encouraging the setting up of such installations. The advantage of doing away with any handling at the station, whether on the unloading lines or in the goods depots, largely makes good the drawbacks of having to bring the wagons up at certain hours close to or right alongside the client's depots.

3. *Wagon-conveying trailers.*

At the Rome Congress, the Administrations represented had to recognise that it was premature from the trials made with wagon-conveying trailers, containers and rail-road trailers to come to any conclusion that one rather than the other of these was to be recommended. It was consequently suggested at that time that the trials should be continued, stressing the fact that it was not at all certain that one only of these methods could satisfy all requirements.

The replies to the questionnaire show that in the meantime the use of wagon-conveying trailers has spread to many countries and experience to date in nearly every case is encouraging.

The low speed of the trailers limits it is true their useful sphere of action to a few kilometres, corresponding more or less to the usual haulage zone. This is why the increased speed obtained by the German Federal Railways with a new trailer which can be folded up when empty deserves particular attention.

Provided these vehicles have a good user — the S. N. C. F. calculates for example that there should be a minimum of four wagons coming in or being dispatched daily — they are cheaper in cost than ordinary haulage. In addition to the saving in time and labour, the use of such trailers makes it possible in addition to prevent any risk of loss or damage of the goods by doing away with handling in the station.

Within the haulage zone, the wagon-conveying trailer is therefore an invaluable link between the station and the industrial firm which on account of natural obstacles or particular circumstances cannot be directly linked up to the railway by means of a private siding.

The drawback of this system is the very high cost of the trailer and tractor needed to haul it. This factor has to date prevented certain Administrations from putting such vehicles into common use and even led one railway to give up operating them itself.

4. *Complete wagon bodies and large containers of all types.*

It is not the practice to transport complete wagon bodies.

The use of large containers of all types makes it possible to obtain door to door transport of large consignments and full loads, an advantage from which the railway is endeavouring to obtain the utmost benefit. Several countries are developing containers used with special carriers (« pa » containers). Improved unloaders are gradually being put into service which make it possible to handle such containers with the minimum delay. In addition to the machines described in chapter I B 2, letter *a*, we give hereafter a photograph of the « Weeser » unloader used in Germany. This machine is also operated by a single man and can pivot in three directions (fig. 31).

The general use of such containers (« pa ») however comes up against the problem of the rational use of the tractors and trailers or special drays (D. A. F. unloaders, Weeser (1), Ackermann, etc.) used for the transport of these containers between the station and client's premises. For this reason some railways (D. B. and Swiss C. F. F.) are now carrying out trials with simpler machines, such as lorries or road trailers with the standard type of

(1) Some trailers of this type are fitted with removable lorry platforms.

platform equipped with some device to move these containers without having to use special vehicles. This method has the advantage of making it unnecessary to limit the use of such containers to stations equipped with special unloaders. In addition, it also makes it possible to reduce the cost of terminal transport very considerably.

If a container is consigned on its own, there is the drawback of an increase in the cost owing to the fact that the optimum loading of the full wagon is not realised. To remedy this certain countries have arranged for containers to be grouped by specialist firms (France, Spain). In France, for example, the company formed for this object gives the consignor of a single container tariff conditions intermediate between the prices usually charged for such a consignment and the prices applying to the simultaneous consignment of several containers qualifying as a full load.

To facilitate grouping and the full user of the rolling stock, it is extremely valuable to be able to use as much as possible the type of container most suitable for the tonnage and kind of goods to be carried. The different categories of containers of the classic types, with or without feet, seem, in view of their variety more suitable for this than the « pa » containers, three of which make a full wagon load. But on the other hand, the classical type of container necessitates the use of lifting gear at the terminal stations. This disadvantage is not very great, it is true, on those railways which have set up well equipped centre stations, fitted with gantries, hoists or modern motor cranes (fig. 32).

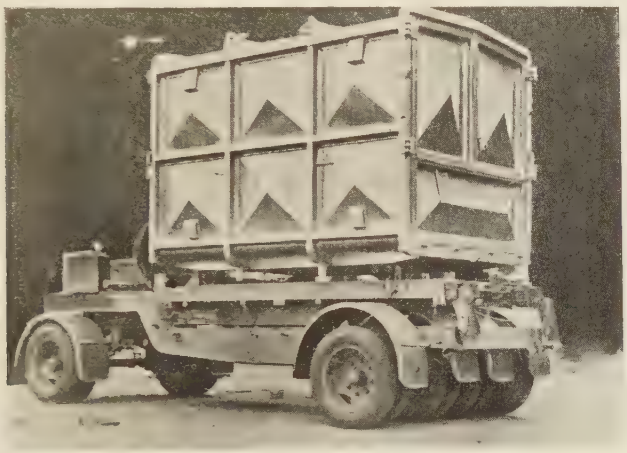


Fig. 31. — *Germany*. Weeser unloader.

The information supplied by the Administrations consulted, though considerable and full of interest did not make it possible for the reporter to make any comparison of the cost likely to weigh the scales in favour of one or other of the two methods (« pa » or classical types of containers).

The advantage of the system of using « pa » containers with D. A. F. unloaders was stressed by the Netherlands Railways (rapidity of handling and transhipping). But it is necessary to have an intensive user of the unloader in a *limited area* (about 5 km [3 miles]) if the costs are to remain reasonable. This condition is not always fulfilled. Germany reported very great

variations in the user of such vehicles. A recent communication pointed out that only 10 to 15 stations used such vehicles to the fullest possible extent. In Switzerland, trailer, the container takes up less space and has a wider sphere of action, is easier to handle and transport. Both systems have their merits.

Fig. 32. — *France.* Weitz motor crane

likewise, the same remarks apply, but it is necessary to point out that in this country the Dutch system has not yet been fully developed.

Compared with the wagon-conveying

5. *Rail-road trailers.*

Since the Rome Congress, the development of rail-road trailers has not been along any new lines likely to modify the summaries of this Session.

Apart from the prototype designed in Switzerland (Brasserie de Rheinfelden), mention must be made of the covered motor trailers put into service in Sweden experimentally, which have four wheels, and a capacity of 4 tonnes, the platform being 2 150 × 3 450 mm, so that three such trailers can fit on one wagon. In order to avoid running empty, these trailers, like the large containers, are only used on certain important services. They must each carry a minimum load of 2 500 kg.

The general use of rail-road trailers is, in fact, still more or less limited to France. One service of this sort is however in operation between France and Brussels and Antwerp, using French stock. Experiments are being made in Switzerland and Sweden. In Austria, it is also proposed to put into service rail-road trailers for the traffic between Voralberg and Lower Austria.

* * *

It can be concluded that the choice between the different technical methods available for the door to door transport of full loads (wagon-conveying trailers, large containers of all kinds, or rail-road trailers) is determined above all by the decision as to which of these methods is the best adapted to the geographical, technical and commercial conditions of the traffic in question.

Under these conditions, there does not seem to be any point in the railways going in for specialisation at any price, and in a one-sided way, regarding the methods they use to assure door to door transport. In spite of the different costs, several methods can very well be in use simultaneously, and complete each other, so that the railway administration is in a better position to offer its clients whichever method in the most suitable, even if not the cheapest.

6. *Mechanical transhipment of full loads.*

The technical methods used for the mechanical transhipment of full loads were examined during the XVth Session of the International Railway Congress Association in 1950.

As stated in chapter II, A, 2, the diversity of the equipment used, and the different conditions under which they are used according to the place and circumstances, make any exact comparison impossible.

The railway administrations tend gradually to mechanise their station cranes and in addition to purchase motor cranes in order to speed up transhipment and reduce the terminal costs (1). The flexibility of motor cranes has undeniable advantages. They can travel very rapidly from place to place, going from one station to another or from a station to client's premises, so that they are an invaluable auxiliary at terminal points. The railways are therefore extremely interested in them.

7. *Manual transhipment.*

Manual transhipment, usually with the aid of small tools (sack barrows, trucks, trolleys, etc.) is still the method most widely used on all railways. It results in high labour costs, owing to the longer time taken. It involves a longer occupation of the unloading sidings, as well as longer immobilisation of the rolling stock whose user in reduced thereby.

8. *Small containers.*

The questionnaire sent to the various Administrations was concerned above all with the best utilization of containers, which according to the technical prescriptions laid down by the U. I. C. come into the category of articles with a maximum useful capacity of three cubic metres.

The U. I. C. and B. I. C., after very detailed studies, having defined the conditions with which the containers recognised by the chief European Railways must

(1) It has been calculated in France that the cost of the terminal charges (handling and haulage at each end of the railway journey) represents 77 % of the cost of the transport from station to station in a 20 t wagon over 250 km (153 miles) (the average journey distance in France in 1950), or 44 % of the cost of transport from one end to the other.

comply, the information concerning the best way of using containers intended to carry small goods cannot differ from the conclusions taken into account in deciding the rules adopted by the said Unions.

a) Most of the railways use small containers, whose capacity varies between 1 and 3 cubic metres, generally corresponding to the international standards. But the 1 and 2 cubic metre types (types A and B) are preferred. The 3 cubic metre type (type C) is not particularly favoured at transhipment centres as it is much more difficult to handle, at least in Germany. In Algeria, however, 3 cubic metre containers have been found satisfactory. In Portugal, metal containers of this size are preferred to wooden ones as they are lighter;

b) Regarding conditions of ownership and use, there are various tendencies. Several Administrations (Denmark, Germany, Austria, Czechoslovakia) consider that small containers should be owned exclusively by the railway, so that the latter can arrange for their use as required and thus limit empty runs as much as possible. In France and Switzerland, on the other hand, the railway prefers a mixed system (1) which, in their opinion, best meets client's requiremetns. In Holland, the N. S. prefer privately owned containers. They state that this means that the containers will be better adapted to the special requirements of the goods being carried. In addition, the railway does not have to invest so much capital. In Italy, finally, the F. S. consider that permanently hiring out their containers to the firms using them on their own behalf is entirely satisfactory.

The choice of method depends on a great many factors which vary from country to country. From the replies received, the reporter was not able to come to any definite conclusion in favour of one or other method;

c) Table VII (question 11) shows that the percentage of empty runs to the total runs differs very little according to the method used. However, the figures quoted by the Swiss C. F. F. show that the percentage of empty runs in the case of privately owned containers (carried free) is much higher than in the case of railway owned containers. It can be concluded that charging for empty runs, as is done in many countries, is a very useful way of making users reduce such transport to the minimum;

d) The hire charges made by the Administrations generally cover the cost of purchase, amortization and maintenance.

There are however a few exceptions in that such a charge

— is not made in Algeria and Portugal;

— only partly meets the cost in Belgium;

— exceeds the costs by 50 % in Germany, to make up for the free transport of the container itself (tare);

e) The methods of calculating the transport charges varies a great deal. It appears that the minimum weights on which the charges are based vary on each railway. The differences do not actually matter much, as the required weight is generally exceeded. In fact it is not customary to use containers for goods consigned in small lots.

In the case of empty runs, the method of charging also varies considerably on the different railways. Where the mixed system is in force, a distinction is nearly always made between privately owned and railway owned containers. Only the Swiss C. F. F. carry empty privately owned containers free of charge on certain conditions.

In view of the great variety of methods and special features in each country, it is not possible to formulate any summary from the replies received.

At the most, one can ask whether it would not be better to charge for transporting privately owned containers when empty, even if only a very small amount, in order to encourage the owners to limit empty runs as much as possible as these

(1) Both railway owned and privately owned containers are in use.

are costly for the railway. It is also possible to hand over the management of all privately owned containers to an affiliated company, in order to reduce empty runs as much as possible. However, whatever the method of management and allocation, there will always be a certain percentage of empty runs, in view of the fact that there are certain areas where the *incoming traffic predominates* and others where the *outgoing traffic predominates*, as the Belgian Railways so pertinently pointed out in their reply to question 13:

f) Several railways calculate the cost of haulage :

— for loaded containers, according to the gross weight;

— for empty containers, according to the tare, if necessary half the latter.

But there are a great many exceptions : in Belgium, for example, the charge are based on the net weight of the goods. In France on the other hand, the fixed charge per 100 kg gross weight includes, when the consignment is picked up at the client's premises, the bringing up of the empty container, whereas when the loaded container is delivered to the consignee's premises, no charge is made, as the rates include the delivery charges. S. N. C. F. empty containers are collected from the consignee's premises free of charge.

In Germany, no charge is made for the collection or delivery of empty railway containers.

Thus it will be seen that the methods differ according to the country. The conditions under which haulage takes place (by the railway or by its appointed carrier) also affect the method to collect the charges for collection or delivery.

9. *Pallets.*

Although small containers are now being used on a very satisfactory scale for the transport of small consignments, as the numerous publications of the B. I. C. testify, the same cannot as yet be said in the case of pallets. Yet, provided the necessary fork-lift trucks are available at both the departure and arrival stations and that consignments are as far as is possible carried on the same pallets from the consignor's premises to those of the consignee, there is no doubt but that pallets, rather than wagons or containers, are the ideal means of assuring the transport of consignments of goods with the minimum handling from one end of the journey to the other.

Full profit is made of the advantages of the pallet only when they are used by the producer, the stockist, the transporter and the consignee. Each one will then obtain the full benefit from using them and the ease of handling they give in getting door to door services may assist the railway in keeping clients who very often are afraid of complicated handling operations, which cause much damage and trouble.

The replies received to the questionnaire show the value the railways place upon the development and generalization of the use of pallets. All those already using them stress the important savings in handling operations due to the introduction of this system and underline the advantages they bring. Equally important points that should be noted : the use of pallets and fork-lift trucks in the goods depots increases output, makes it possible to speed up unloading and the turnround of stock, and finally assists in preventing damage.

Standardized pallets of the standard type (U. I. C.) ($1\,215 \pm 5 \times 810 \pm 5$ mm) are recommended in order to assure good utilization of the wagon capacity and guarantee the well ordered use of the area available in the goods depot.

As for the fork-lift trucks, various types are in use or under trial. The problem of their size and above all their weight is of great importance in the case of machines used in the wagons, the floors of which are not always in very good order.

The French Railways, who have not yet reached a final decision, consider that in order to make full use of fork-lift tractors,

they should be kept within the following limits :

— their capacity should be about 1 tonne at 40 cm on the fork;

— the weight empty should not exceed 1 500 kg;

— their length should not exceed 150 cm (excluding the fork) and their width 80 cm:

— their manœuvrability should be such that they can turn, with a loaded 120 × 80 cm pallet on the fork, in the space between two walls 3 m apart;

— their speed should be about 15 km (9 miles) /h;

— the fork should have a lift of at least 1.25 m above ground level.

No machine built to date fulfils all these requirements.

To guarantee speed of handling and to obtain the greatest economy in labour, it is necessary to make a careful selection of the mechanical methods used in connection with the general use of pallets.

Electric fork-life tractors are heavier than petrol driven ones and require charging plant for the batteries. Their speed is not as constant as that of thermal engines, but in spite of this they have many advantages both as regards consumption and maintenance. The smell of petrol is easily picked up by foodstuffs. The risk of fire also cannot be overlooked. Consequently many countries prefer electric machines. Longer experience will enable the railways to decide which of the two methods they prefer, which moreover fit in very well with each other.

10. *Other equipment.*

Cranes fitted on road vehicles to pick up and deliver containers weighing up to 1 500 kg at client's premises are of great interest. So are low-loading trailers which make it easier to transport small containers between the station and client's premises.

It is not unduly optimistic to foresee the use of cranes fitted on road vehicles or hoists on lorries (Giroud-Olten method) for transporting and delivering to client's premises pallets and box-pallets loaded with important consignments of goods.

* * *

PART II.

PACKINGS.

What are the packing types to be recommended?

Introduction.

Though the International Railway Congress Association has so far only dealt with certain aspects of packings, chiefly in connection with containers, the work of other organizations must however be mentioned, particularly that of the U. I. C. which led to the adoption of note 14 : « Regulations concerning packing materials used for parcels in international traffic ». Again mention must be made of the International Convention on the Transport of Goods (C. I. M.), and its Appendix I which imposed the use of given types of packings under certain well defined conditions. The inland transport committee of the C. E. E. (Geneva) has also frequently dealt with the packing problem: its work moreover has had a certain effect on the last clause of note 14 of the U. I. C.

As these documents and deliberations are available to everyone, we will merely refer to them as occasion arises.

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To facilitate the comparative examination of the different parts of the problem, we will keep to the same order as that used in the questionnaire, grouping the various items under the following headings:

	Questions	Page
1. *Packings used :* their advantages, their drawbacks; the ideal packing	1-5	469/117
2. *Methods used to improve the quality of the packings :*		
a) by regulations : the rules and their enforcement	6-11	472/120
b) the limits set by competition to such regulations	20	474/122
c) the influence of the cost of transport of empties and the cost price on the re-use of packings	21-25, 28-30	474/122
d) by persuasion : advice to users, propaganda to encourage better packing tarif measures	26-27	480/128
3. *Methods of investigation to discover what constitutes a good packing :*		
a) empirical methods	15-16	481/129
b) scientific methods :		
1) examination of transport conditions (stresses, shocks which packings have to stand up to during handling and transport)	17-19	482/130
2) examination of the strength of packings (to stresses, shocks, bad weather, etc.), both as regards their component parts : strength of the materials; and as a whole : quality of the packing	12-14	483/131

1. The packings used; their advantages, their drawbacks; the ideal packing.

(Questions 1 to 5.)

QUESTION 1. — *What types of packing are normally used by consignors of goods over the lines of your Company :*

a) *in inland services;*

b) *in international services ?*

We will not give a list, which could not be complete, of the types of packings used on the railways consulted. They correspond, in general, to those mentioned in note 14 of the U. I. C. (1950 edition) and the proposed new note 14 (January 1952).

First of all, a distinction must be made between commercial consignments and occasional transport. The packings of commercial consignments are generally more suitable as they have been more carefully studied (Denmark).

Circumstances during the last two years shown to what an extent economic conditions (cost of packings, scarcity of goods consigned, scarcity of materials used for making packings) can influence the quality of packings (Belgium).

Finally, it may be pointed out that local or national conditions in the raw materials market have a very great influence on the choice of materials (Portugal); sacks will be made of cotton, jute or paper according to whether the materials in question are produced in the country concerned.

It can however be stated that in general,

packings intended for use in international traffic are more solid, heavier and better designed than those used in internal traffic.

QUESTION 2. — *Have these types of packing proved satisfactory? If not, why?*

In general, yes.

However, the railway is obliged to keep a check on the quality and limit re-utilization (France).

In Austria, packings frequently have the following defects : insufficient protection against theft, insufficiently watertight, too wide gaps between too thin boards.

The Danish Railways complain of the poor quality of paper sacks and cardboard boxes; the packings used for glass allow it to be broken too easily; the seams of tin cans will not stand up to normal pressure. As for open boxes, these do not protect the fruit which is damaged or dirtied, and also complicate stacking.

The Finnish Railways do not think cardboard cartons are strong enough for the transport of bottles or demi-johns.

Wicker-baskets are not suitable for the transport of fresh fruit in Portugal (they cannot be stacked and do not protect the fruit sufficiently); their use has been successfully restricted by discriminating tariffs (see question 26).

Paper sacks and the packing inside the cartons have been found unsatisfactory by the French Overseas Railways. The matting, bamboo, etc. used on these same railways are too fragile and too inflamable (wood fired locomotives).

The Turkish Railways have found the packings used unsatisfactory, and consider they are too heterogeneous.

QUESTION 3. — *What types of packing do you think are the best for the different kinds of goods carried?*

In general, the straight parallelepipedal form of packing is preferred as this makes it easy to stack and results in the optimum user of the full wagon capacity and handling gear. However, in the case of heavy parcels, it is necessary to modify the outside form of such packings slightly in order to provide means for facilitating handling (cords, handholds, tassels, skids...) (Belgium, Norway).

As regards open boxes for fruit and vegetables, these must be provided with something to keep them from slipping and something to strengthen them (lower and upper strips) (Italy). The proposed note 14 U. I. C. (1952) takes these suggestions into account.

Though the stowing of cylindrical parcels may present some difficulty, this form of packing also has certain advantages (strength, lesser area, can be rolled) (Belgium, Switzerland).

Some railways, in consultation with their Governments, have endeavoured to standardize packings : not only as regards their shape but also as regards dimensions, so that loads formed of various goods can be assembled into a homogeneous whole on the convevors or wagons. For example the Swedish Railways have adopted 1 200 × 800 mm (3′ 11 1/4″ × 2′ 7 1/2″) as the standard size, which can be divided up in the ways shown in the table on page 471-119, thus meeting all requirements.

QUESTION 4. — *What characteristics should such packings have in order to make them*

a) *firm;*

b) *stackable;*

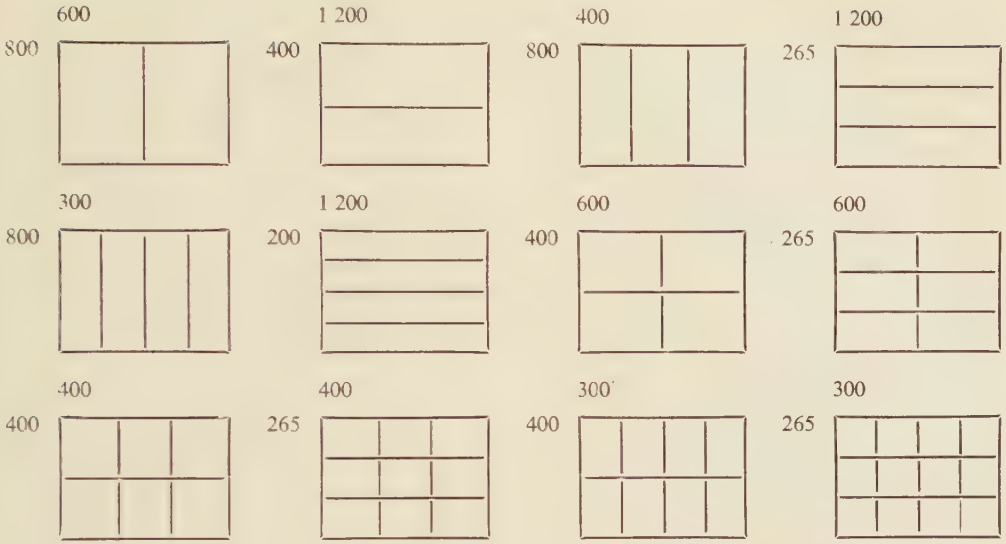
c) *possible to ventilate them?*

a) *Strength.*

Characteristics :

Use of sound materials (France), free from any odour and suitable for foodstuffs (Italy, Finland), in sufficient quantity (thickness), assembled (stuck together, nailed, tied, etc.) with care (France).

However, each transport should be examined on its own merits : the distance, frequency of handling and whether belts,



trucks, trollevs, etc. are used, all affect the issue (Germany, Sweden).

b) *Possibility of stacking or piling one on the other.*

Characteristics (see question 3) :

parallelepipedal form;

standardized dimensions (Italy, Mozambique);

strengthening device built in with the packing (Belgium, Norway).

In the case of sacks; use of woven sacks as paper sacks are liable to burst under the weight (Austria).

c) *Possibility of ventilation.*

Characteristics :

covers with thicker end to keep the layers apart (France), lattice-work (France), air holes (Denmark).

QUESTION 5. — *Are there any circumstances which make it necessary to make additional stipulations as regards these types of packings due to :*

a) *the climate :* mention may be made of boxes with double walls to carry ice (fish traffic), cork insulation against heat in the case of wines intended for the tropics (France) and protection against humidity (Mozambique);

b) *position during transport :* in order to prevent certain parcels being turned upside down (accumulators, etc.), in the proposed new note 14 U. I. C. it is suggested that the covering should be dome-shaped or similar (ridged). The same document provides that in the case of machine-tools, the packing should have a bottom frame forming a *sledge* to which the machine can be firmly fastened. Overhanging parts must be strongly *stayed*;

c) *transhipment during transport :* in the case of full loads (different gauge lines, transport by sea) the packings should comply with the conditions laid down for parcels traffic (see under *e*);

d) *use of mechanical or other devices :* (see the remarks under question 3 relating to heavy parcels) skids so that the forks of an elevator can slide under the bottom of the parcel;

e) *the quantity of goods sent for transport* : (part of full loads) : obviously in the case of full loads which are usually not transhipped during the journey, the packings need not be so strong, especially when the goods form a more or less homogeneous whole.

f) *risk of theft* : such risks vary according to the political and economic situation of the country concerned, according to whether the goods being transported are scarce and in demand or otherwise.

If the value of the goods is high, the packing should be such that it makes theft impossible; in default of this, any tampering with the package should be at once apparent : breaking of the lead seal (France); the Swiss Federal Railways recommend the making of special cases, provided with grooves which prevent the cords or wires used for tying the parcel from being rubbed during handling or on the journey;

g) *other circumstances* : the Italian Railways think it important that the same type of boxes can be used for fruit and vegetables with or without covers. In addition, they consider it desirable that such boxes should, when new, be easily dismantled and easy to stack, and quickly assembled for use.

The Austrian Railways remind us that in the end the factor « cost price » of the packings is extremely important in view of road competition (see question 20).

* * *

2. Methods used to improve the quality of packings.

a) *By regulation the rules and their enforcement.*

Questions 6 to 11.)

QUESTION 6. — *Has your Administration any regulations concerning packing and if so, what are they?*

a) *do these regulations apply to certain types of packing?*

b) *do these regulations apply to certain goods?*

Let us mention first of all regulations of an international character :

Appendix I to C. I. M., note 14 of U.I.C., certain clauses of which are obligatory.

Here there are two opposing tendencies.

Some railways are content with very vague regulations or directions : goods must be carefully packed (Thessaly) or sufficiently packed :

to comply with the length and exigencies of the transport (France) :

to preserve the goods from total or partial loss (Holland, Norway).

Other railways do not appear to have any regulations at all (Italy, Algeria, Greece, Luxemburg, Morocco, Mozambique, Turkey).

In fact, some (Sweden) are very much against any attempts to lay down any regulations in this matter on the grounds that :

only the consignor knows the special characteristics of his goods, the results obtained with previous consignments, the character and extent of any damage occurring;

it would be too much to ask the railway staff to decide whether goods were sufficiently or insufficiently packed, as they do not know the nature of the contents, the interior packing, the strength of the materials used.

The Portuguese Railways think that every consignor does his best to use the most suitable packing, so that no striking improvements are possible.

The Netherlands Railways share in the first of these opinions and consider that regulations would only have a bad effect; on the other hand they consider that it is necessary to have a laboratory for the benefit of consignors in order to determine the efficacity of any new types of packing (see question 12).

This is the tendency in the first place; in the second place instructions are issued :

1) with the object of *training the staff* so that they are able to judge of the efficacity of packings (this does not bind the users therefore) (Germany, Switzerland):

2) based on Note 14 U. I. C to define the *technical conditions* with which certain packings should comply if an *official stamp of approval is to be granted*, which confers certain particular rights on the user :

a) special tariffs (see question 26):

b) increased responsibility for the railway, as defined in Article 14 of the S. N. C. F.'s Tariff III, an extract from which reads :

« In case of damage occurring to consignments in inland French traffic packed according to the conditions... the S. N. C. F. will not make a defect in the quality of the packing an argument against their responsibility... »;

3) based on Appendix I to the C. I. M. relating to dangerous or infected, etc. materials, *for the information of users,* imposing such and such types of packings and laying down the limits of the responsibility of the railway (France : for valuable goods: Finland : for foodstuffs, paper sacks).

As will be seen from the above examples, these regulations either relate to the type of packing : cartons, sacks, etc., or to the categories of goods they hold : valuable goods, foodstuffs, etc.

QUESTION 7. — *If your reply to question 6 is in the affirmative, is this due to the fact that the regulations summed up under 6* a) *are not satisfactory?*

In general, it can be said with the S. N. C. F. that the regulations given under 6 *a)* and 6 *b)* mutually complete each other.

QUESTION 8. — *Have your Company's regulations about packing been influenced by the extent of the Company's responsibility from the point of view of damage during transport?*

In general, yes : when any regulations have been passed.

However, the Belgian Railways, by a systematic study of the causes of accidents, have endeavoured to establish minimum criteria to be observed in the packing of goods, in order to *prevent damage.*

In Sweden, only *recommendations* have been published, in order to comply with the wishes of the authorities, of industry and commerce, with the sole object of finding the most suitable and *most economic packing.*

QUESTION 9. — *Are your Company's regulations about packing generally respected?*

The replies were in the affirmative. However, the Netherlands Railways, who have merely published recommendations, find that consignors often do not follow them :

a) owing to the shortage of materials;

b) through ignorance;

c) for reasons of economy, as road hauliers are less exigent (see question 20).

QUESTION 10. — *If your reply to question 9 is in the affirmative, how is the fact that the regulations have been complied with checked?*

Most countries are content with an examination when the goods are accepted for transport. Some have organized a supervision service during the journey (Portugal).

Those railways, who have introduced the principle of official approval, control the packings from manufacture (France).

Others endeavour to persuade consignors to take their packing problems to a special laboratory (Belgium, Holland) (see questions 12-14).

QUESTION 11. — *What is the attitude of your Company towards consignors who do not comply with the packing regulations?*

According to whether the regulations are obligatory in character or merely a guide,

the railway will refuse to accept the consignment or only accept it at owners risk. These reservations are usually stated on the consignment note.

If the recommendations are not observed, the risk, in case of dispute, will usually be the consignors (Belgium).

When tariff benefits are linked up with special packing conditions, if these are not observed, higher rates will be charged (France) (see question 26).

2 b) *The limits set to the regulations on account of road competition.*

(Question 20.)

QUESTION 20. — *Is the competition of other methods of transport such that it is inadvisable to insist on the standard of packing railway transport would normally require?*

Opinions are very divided, which is easily understandable since the character of the regulations is very diverse (see question 6 above) and competition between the railway and other methods of transport varies considerably.

The railways which replied in the *negative* were those of Algeria, Greece, Luxemburg, Morocco, Mozambique, Norway, Czechoslovakia and Turkey. As they made no comments, we take this as being due for the most part to the absence of any regulations.

Amongst the *affirmative* replies, first of all those made with some reserve must be quoted : In France, competition from other methods of transport cannot affect those packings which benefit by reduced rates. But is not the fact that such rates are granted due to competition? (see question 26).

The Belgian Railways see in their method of preventing damage (advice on the best packing from the point of view of strength and cheapness) an excellent defensive weapon.

The Swedish and Netherlands Railways find this another argument against any definite regulations.

There are finally some railways who resign themselves to admitting in their regulations methods of packing which they do not consider satisfactory with the sole object of retaining the traffic : Germany, Overseas France.

2 c) *The influence of the cost of transport empty and the cost price on the re-use of packings.*

(Questions 21-25 and 28-30.)

QUESTION 21. — *Are you of the opinion that packing should or should not be re-usable, i.e. returnable or not?*

Opinions are very divided according to the point of view held.

Considered from the political angle (national or international) the re-use of packings appears desirable (Norway), especially as these materials are in short supply (in general or in the countries considered).

However, this advantage rapidly desappears with wear of the packing materials, as *the losses thereby caused to the goods are greater than the cost of the packing materials*. And as the scarcity of packing materials is essentially a matter of *conjuncture*, it follows that in times of abundance it is preferable to scrap the packing after use (moreover they can nearly always be recovered).

From the *consignor's point of view*, the problem looks quite different :

He is concerned with the comparative cost of each method. Without claiming to be complete, we give in the following table the chief factors influencing the cost price which have to be taken into account in this connection.

However difficulties in *obtaining new stocks* may make it necessary to renounce the other advantages of the once used packing.

Finally taking the *point of view of the*

Points of comparison of the two methods of packings used :

	Packing scrapped after use	Packing re-used by the consignor
Cost price	Low	More costly
Interest	While in stock : low	According to the probable life
Amortization	100 %	According to the probable life and according to commercial custom (possibility of invoicing the packing and probability that it will be returned)
Cost of transport loaded	Lighter packing	Heavier packing
Cost of return transport	None	According to distance and weight
Stocking facilities	According to whether the new packing takes more or less space than the used packing According to the space available, whether it has to be stored in a dry place	
Rythm of the consignments :		
Seasonal consignments	Large orders, low prices, short store period;	Large stocks unused out of season;
Regular consignments	Longer in store or smaller and dearer stocks	Small stocks always being turned round
Saving in labour :		
Preparing the packing Filling the packing Fastening up the packing	According to whether certain operations are more or less easy (even useless) when it is a question of used packings	
Repairing	None	According to wear
Cleaning	None, clean	According to the use
Sale value	Can be sold separately	—
Value to the consignee	Can be used for fuel, to make something else, for transports of the consignee	None

railway, here again we find many differences of opinion.

1) *Regarding the risk of damage :*

On the one hand, they express fears about the re-use of weak packings, especially for foodstuffs owing to their rapid wear (France). For example cartons and tins which the Netherlands Railways do not care to see re-used, especially tins, because it is very hard to prove responsibility in case of damage.

To sum up, it is the fear of damage and having to pay claims that makes certain railways stipulate that packings shall only be used once. As a result of this opinion, many will not grant any reduction in rates for empties (see question 24).

On the other hand, certain railways prefer very strong (and consequently expensive) packings to be used, claiming that the risk of damage is thereby reduced, even when such packings are used several times (Germany, Austria, Luxemburg). Consequently, they grant cheap rates for returned empties (see question 24).

Thus we see that the same considerations (fear of damage) leads to opposite conclusions which can be explained by the agricultural or industrial character of the country concerned. It is understandable that fruit and vegetables cannot bear the cost of expensive packings : hygienic foodstuffs implies the use of clean and consequently new packings.

2) *Regarding the danger of competition :*

All the railways unanimously recognise the impossibility of insisting on new packings in every case. Such a stipulation would encourage competition, especially haulage by the consignor himself who on each run would deliver full cases and collect the empties, thus assuring his return load.

QUESTION 22. — *What do you think of types of packings that can be folded up ?*

The French, Belgian and Austrian Railways do not find them satisfactory. The presence of hinges and pivots, which never get repaired, and their fragility are a frequent cause of litigation between the transport undertaking and its clients (Belgium).

It appears however that the Collico packing (of German origin) which is also used in Switzerland is fairly strong. Experience is however too recent for a final opinion to be formulated (Switzerland). The German and Swiss Railways favour the use of such packings by hiring them out to consignors (fig. 33).

In Switzerland, consignments are charged on the gross weight. The difference in tare between the heavy and light models is post paid. Transport in the flat (folded) is invoiced to the operating company and consequently included in the hire charges.

Most of the railways think however that folding packings have a great future in front of them, especially in view of their specific weight empty. One railway goes as far as suggesting special rates for goods packed in them in order to encourage their use, on condition they replace thin, rigid packings (Portugal).

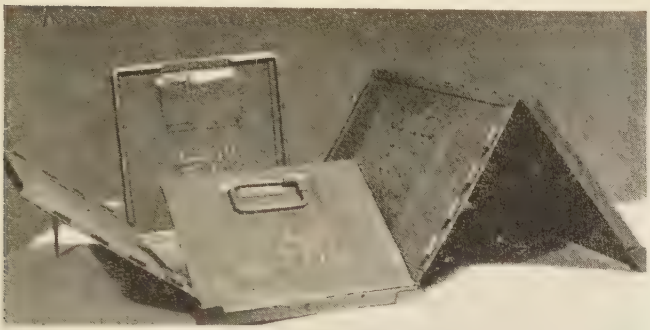
QUESTION 23. — *What types of packing are used more than once for the same type of goods in your contry ?*

And what is your experience in this connection ?

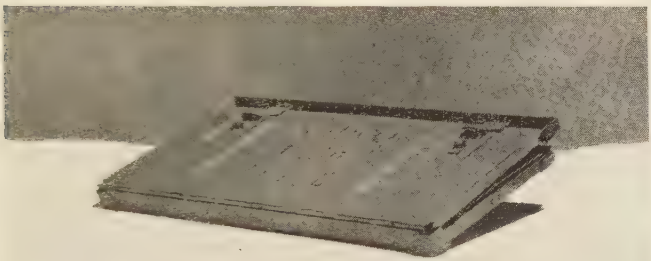
The types of trade packings that are reused are generally heavy or costly : wooden packing cases, wood or metal barrels, drums, carboys, gas cylinders, woven sacks. Mention may also be made here again of folding packings (see question 22) and containers, which are so designed solely that they can be re-used.

The proportion of packings used again or scrapped is however according to the state of the market (France).

The Austrian Railways complain of leaks in barrels and drums used more than once. The Danish and Netherlands Railways do not recommend the re-use of cardboard



Folding *Collico*.



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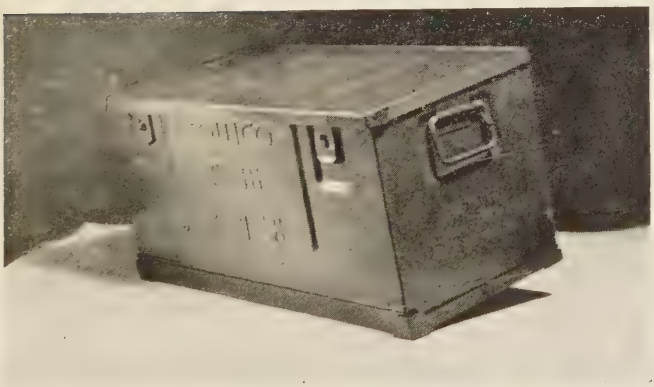

Collico case ready for transport.

Fig. 33.

cartons, whereas the Finnish Railways find this satisfactory. The Netherlands Railways have had unfortunate experiences with re-used paint tins (see question 21).

QUESTION 24. — *Do you make any provision for reduced rates and in the affirmative what are the special tariff regulations :*

a) *for the transport of returned empties used in connection with goods transported by you on the outward journey;*

b) *for the transport of empties destined for goods to be shipped by rail subsequently ?*

QUESTION 25. — *Are these special tariff regulations applicable to :*

a) *all types of packing;*

b) *types of packing complying with certain requirements ?*

In case b), *what are these requirements ?*

1) *Returned empties.*

We saw above (question 21) that the French Railways condemn in principle the re-use of packings and consequently do not grant cheap rates for returned empties. In France, there is only one such rate, for the return of empty milk churns.

On the other hand, other railways grant special reduced rates for returned empties to a greater or lesser extent.

The conditions vary from country to country : some concern the *period in which the empty must be returned.* The Finnish Railways fix this at one month, in most cases the *time* within which the empties must be returned is increased in the case of gas cylinders, milk churns, and the packings used for mineral waters: the Danish Railways allow three months and the Belgian 6 months from delivery.

Other conditions concern the *minimum unit weight* : in Austria the unit weight of certain packings must be at least 75 kg (165 lbs.). The reduction given thus tends to compensate for the extra cost (compared with light packings) of the loaded journey. In Luxemburg the weight of the packing must exceed 50 kg (110 lbs.).

Several railways only grant reduced rates for *certain types* of packings (question 25). These are : in France, milk churns; in Italy, wooden, willow, iron and glass containers (demi-johns, wickered wine bottles); in Holland and Mozambique, durable packings. In Austria, heavy packings (iron casks, barrels, drums, gas cylinders, packing cases weighing more than 75 kg); in Morocco, woven sacks whose value does not exceed 250 fr.; in Czechoslovakia, folding packings, glass carboys or bottles, iron casks and sacks. The Thessaly Railways grant special rates for packings for fresh fruit, cement, liquid fuels, cigarettes, etc.

The rates may also be affected by :

The way the packings are sent back the Algerian Railways grant more favourable rates for packings : « taken apart, folded up or packed into each other ».

The destination of the empties : The German Railways have two scales of reduced rates according to whether the packings are returned to the consignor (50 % reduction) or to a repair, salvage, or packing hire depot (30 % reduction).

Many railways impose *formal conditions* : in Holland, the consignor has to prove that the empty came by rail and mention this on the consignment note; in Austria, the wording of this declaration is specified; in Switzerland the consignor merely has to make a statement to this effect; however the railway can ask him to produce the consignment note for the goods in question and mark the return of the empties on it; in Algeria, the consignor has to produce the consignment note for the goods in question when asking for the empties to be returned at the reduced rates; in Spain, the consignor of the goods has to ask for the empties to be returned.

The *amount of the reduction* granted varies from railway to railway : 10 to 18 % in Morocco, about 30 % on the French Overseas Railways; it is 50 % (of the carriage or the weight) in Germany, Austria, Holland, Luxemburg, Switzerland and Czechoslovakia; it is up to 60 % in Spain. Certain types of packings can even be returned free of charge (or almost so). In Finland : rate of 1 MK for milk churns and water tanks; in Switzerland : foodstuff containers and milk churns sent on the special 4 41 rates are returned free, and also in Thessaly.

2) *Empties travelling to pick up loads.*

Most of the conditions given under 1) apply. There are however a few differences :

No reduction in Austria, Finland, France, Overseas France, Greece, Mozambique, Norway, Portugal and Turkey. In Italy, this facility was only introduced in 1950.

Several railways only grant the reductions for returned empties or packings sent to be loaded by means of *refunds;* these are Algeria (within one year), Germany, Belgium, Holland (within one month), Luxemburg and Morocco.

QUESTION 28. — *In your opinion are the reduced rates mentioned under 24 justified technically from the point of view of the cost to the railway?*

QUESTION 29. — *If your reply to question 28 is in the negative, what considerations have led you to grant these reductions?*

A distinction should be made between the special cost and the total cost.

The first applies solely to the transport of returned empties, theoretically isolated from all other transport.

The second takes into account the transport of returned empties as a complement to the transport of the goods (Denmark, Sweden).

Most railways consider that the *special cost does not justify any reduction.* The German Railways however think that reductions granted in the case of folding packings (Collico) are justified owing to the high specific density and the small space they take up.

On the other hand, when considered from the point of view of the *total cost,* we must agree with many railways that :

reductions granted for returned empties in the case of heavy packings are made good by the additional receipts obtained from their transport when loaded (Austria);

empty packings contribute towards obtaining a better use of the capacity of the wagons (Turkey), especially when travelling in the direction with the smallest traffic (Overseas France);

reduced rates for returned empties tend to stimulate the goods traffic and in addition contribute towards reducing the cost; in other words they are another weapon against competition.

Other considerations than the cost to the railway : reduction of the cost of packings (Germany), especially when commercial usage means that they are invoiced to clients (Switzerland) have also contributed towards the elaboration of these special rates.

QUESTION 30. — *Have the reduced rates granted for returned empties encouraged the use of types of packings which can be used more than once?*

Many railways would not commit themselves on this point.

Whereas the Algerian, German, Austrian, Danish, Spanish, Finnish, Greek (Hell.) Luxemburg, Mozambique, Norwegian, Swedish, Swiss, and Turkish Railways replied in the affirmative, those of Italy and Portugal denied that this was so.

2 d) *Persuasive methods : advising users, propaganda in favour of better packing, rating measures* (questions 6-27).

Although the questionnaire only dealt with one aspect of this problem (rating measures), it can be admitted *a priori* that the railway staff are available to advise occasional consignors and help them to find the most suitable packing and correct any obvious defects. As we will see when considering question 15, the staff dealing with lawsuits is generally qualified and in a position to prevent the repetition of similar accidents if its advice is taken.

We shall also see (question 12) that there are research laboratories whose purpose is to advise consignors as to the most suitable method of packing, often free of charge.

Finally, mention must be made of the efforts made by the Governments and professional associations to improve the packing of agricultural products.

The latter may even have an obligatory character in the case of some traffic. For example Article 1 of the Governmental Decree of the 22nd November 1938 detailed the regulations applicable to the *standardization of packings* used for early fruits and vegetables leaving Algeria.

« In order to achieve, on the one hand, homogeneity and an improvement in the presentation of Algerian products on the different export markets, and, on the other hand, to regulate the transactions thanks to the determination of relatively invariable tares no paks used for consignments of early and other fruits and vegetables will be allowed to leave the country unless mentioned in the present decree or complying with the following specifications.... »

Such packs, intended for export, soon supplanted other models even in the internal markets.

QUESTION 26. — *Is any provision made in your tariff system for special reduced rates when goods are carried in certain approved types of packing? If so, give details about your standards and a detailed summary of these rating regulations.*

We will mention in passing the reduced rates granted to transports in containers (based on the net weight of the contents), which many railways also grant to privately owned containers (see Part I, Chapter III A).

The same principle has been extended in some countries to loads carried on privately owned conveyors (Sweden, Finland).

Certain railways, being of the opinion that a good packing :

— facilitates handling;

— reduces the risk of damage, and consequently compensation payable;

— makes it possible to obtain better user of the wagons,

grant certain kinds or types of packings more favourable rates. We may mention the *Algerian Railways*, who favour a packing for shrubs enabling them to be laid on their sides and stacked, as well as protecting metal cans by packing them in crates or boxes.

We have already seen (question 2) that *Portugal* grants a regular reduction of 10 % of the cost of transport in the case of fresh fruits packed in wooden boxes or crates whose maximum outside dimensions are :

0.88 × 0.44 × 0.27 m (2′ 10 5/8″ × 1′ 5 5/16″ × 10 5/8″), or in baskets having certain characteristics, which will fit into a parallelepipe with a base of 0.44 × 0.44 m and a height of 0.27 (exceptionally 0.36 m 1′ 2 9/16″]).

A similar reduction of 10 % is granted by the *Turkish Railways* for standard packings, which fit into each other.

In *Italy*, the sending of grapes in small consignments is encouraged (to prevent crushing) by making good the extra cost by more favourable rates for small crates up to 20 kg.

The *French Railways* have obtained the greatest benefit from approved packings. In fact, as in certain cases specially favourable rates granted to consignments sent in metal cases, barrels or containers, they

extended this facility to consigments packed in *new cardboard boxes or drums*, whose technical conditions complied with certain fixed rules (Regulating tariff No 111) and are officially approved.

In addition, *fruits, vegetables, eggs and fish* under Tariff 3 enjoy reduced rates (about 5 %) when sent in *boxes marked with the official stamp* or of an *approved type* (eggs packed in keyes trays in boxes of 360 : reduction of about 10 %).

The *Netherlands Railways* are studying this question.

QUESTION 27. — *Has it been your experience that the granting of reduced rates for the use of packings conforming to your standards has led to these being used more frequently?*

The replies were in general in the affirmative. The Finnish Railways would not commit themselves owing to lack of experience.

3. Methods of investigation making it possible to establish definite criteria for a good packing.

a) *Empirical méthods*

(Questions 15-16.)

QUESTION 15. — *Are the employees, responsible for dealing with claims for damage, experts on the question of the quality and suitability of the packing of damaged consignments?*

Most railways have trained such staff, either by issuing them with instructions or documents (Belgium, Denmark, France, Switzerland) or by frequent contacts with experts so that in the course of time they become extremely experienced (Germany, Austria).

However certain railways employ special inspectors, attached to the litigation department (Belgium, Portugal). In Holland, the test laboratories are called in in case of doubt (see question 12).

There are however some railways who, owing to the small importance of the damage occurring (Algeria) or for other reasons, have not considered it necessary to train their staff particularly (Greek, Luxemburg, Morocco, etc.).

QUESTION 16. — *What is, in your opinion, the main cause of damage :*

a) *the kind of goods;*

b) *the condition of the packing;*

c) *the handling of goods;*

d) *the transport itself?*

Opinions are very divided. It does not appear from the replies that the railways consulted have systematically analysed the causes of damage. Experience shows moreover that it is rare for damage to be attributable to a single cause, but it is nearly always due to a whole train of events the combined effect of which caused the mishap.

If the laws or regulations make it possible to fix as fairly as possible to respective responsibility of the transport company and of the user, it is still more difficult to be precise about the predominating material cause.

It appears however that :

a) the nature of the merchandise only plays a secondary part (except in Denmark and Thessaly);

b) the packing is often the cause of accidents : (Belgium, Denmark, Italy, Mozambique, Portugal) either because it is not strong enough (Germany, France and Overseas France) or because the goods have not been sufficiently tightly packed inside (Overseas France);

c) handling, especially the method of loading and stowing the parcels in the wagons is at fault (France, Belgium, Germany, Luxemburg, Morocco). The Belgian Railways consider that at least two thirds of the damage occurring can be blamed either on poor packing or faulty loading and stowing;

d) the transport itself : shaking and bumps, traffic accidents, fire when wood firing is used (Overseas France) frequently cause damage to goods (Italy, Holland, Finland, Luxemburg, Morocco, Mozambique, Portugal).

In conclusion, we may state that many railways try to find out why accidents occurred. Few railways carry out systematic research into the causes.

Scientific methods.

3 *b* 1) Examination of transport conditions (stresses, stocks, etc. undergone by the packing during transport).

(Questions 17-19.)

QUESTION 17. — *Does your Administration check the transport and handling of goods by means of certain suitable apparatus (shock recorders) ?*

QUESTION 18. — *If so, what type of shock recorder is the best and why ?*

Scientific study of the packings covers two phases, the first of which is the *analysis of the transport conditions* : recording stresses, vibrations and shocks which the packings and their contents have to suffer during the terminal handling, loading, and unloading, whether manual or mechanical, as well as during the actual railway journey : accelerations (including the push off), braking (including braked stops and collisions), slopes, inclinations, vibrations.

The static examination of the stresses does not occasion any difficulties as the problem is almost the same as in the case of storing. But it is quite different from the dynamic point of view, as it is impossible for recording instruments to be used on each train, or during each shunting movement, like those fitted on the dynamometre cars used for periodic checks on the permanent way. Consequently such an examination has to be made by means of soundings and solid and cheap recording devices.

Several railways use shock recorders, for example Germany, Belgium, Denmark, France, Holland and Switzerland. Others intend to get them : Italy and Sweden.

There are many types of devices, but it is often economic or monetary considerations which rule the choice (Holland).

The most up to date type record not only horizontal shocks but also vertical vibrations : it is the « R-S 2 way side recorder » of the Impact Register Co., Champlain, Illinois, but none of the railways consulted possessed such a machine.

The most widely used types are of French construction (Cornet system) or German (Kienzle and Peiseler) : they record the size of the shocks and the time at which they occurred and are satisfactory. The Swiss Railways say the « Stout recorder » is not sensitive enough.

QUESTION 19. — *If your Administration makes use of shock recorders, are these merely used to control the transport or are they used to investigate the methods of stacking and types of packing used ?*

Their use is multiple : it appears however that up to the present they have been used above all as witnesses, making it possible on the one hand to decide the *relative responsibility* of the consignor and transporting company (absence of any shock recorded being in favour of the latter, and vice versa), and on the other hand to *localise abnormal shocks* so that the repetition of such accidents can be avoided by persuasive or disciplinary action against the railway staff.

It may happen that the load has suffered damage although no shocks have been recorded. Their cause can then be looked for in the kind of packing used, incorrect stowing or other cause. The Netherlands Railways have been able to advise consignors in this way and thereby reduce the number and amount of damage.

All such devices are fixed in the body of the wagon, so that they do not give any

idea of the terminal handling, which is to be regretted, as it is often then that damage occurs.

The Belgian Railways report that recording devices which can be put in the packings are available, but think that the results obtainable are very doubtful in view of their ineffectiveness. It should also be pointed out that they are very costly.

3 *b* 2) *Examination of the strength of packings (to stresses shocks, bad weather, etc.) :*

both as regards their composition : strength of the materials;

and as a whole : kind of packing.

(Questions 12-14.)

QUESTION 12. — *Is there any organisation in your country carrying out researches into packing on a scientific basis?*

QUESTION 13. — *If your reply to question 12 is in the affirmative, what are the relations between your company and this organisation?*

Ten railways report the existence of such organisations. Some of them (Belgium, France, Switzerland) were set up by the railway, sometimes in collaboration with the packing industry (France).

Others have a more or less official character; these are :

in *Algeria* : the O.F.A.L.A.C. (Algerian economic and tourist office);

in *Germany* : the « Packing » Work Society at the German Economic Nationalization Institute at Berlin;

in *Spain* : the National Rationalization Institute;

in *Norway* : the Norwegian Industrial Investigation Society and Standardization Society;

in *Holland* : the Experimental Packing Centre T. N. O at Delft;

in *Switzerland* : the Federal Materials Laboratory at St. Gall,

as well as those of *Denmark* and *Czechoslovakia* with which the railways collaborate more or less closely or consider it would be advisable to do so in the near future.

This collaboration can take various forms :

a) elaboration of packing regulations :

in the case of fruit in Denmark;

supplement to the regulations of transport and the C. I. M. (Switzerland);

examination of the proposed U. I. C. notes (Netherlands);

b) expert assistance in the case of litigation (Holland);

c) examination of defective packings in the markets and sending an explanatory note to the consignor (Holland);

d) control of packings in the case of export goods (Algeria).

The methods used by *the laboratories run by the railways* are :

a) collaboration with industry when new packings are invented :

in cardboard (Switzerland);

all types (Belgium, France),

either to reduce the risk of damage, or to lower the cost of the packing without increasing the risk of damage;

b) granting an official stamp of approval marking the quality of the packing (see questions 6, 26, and 27) (Belgium) and giving a right to tarif benefits (France);

c) standardization of packings, which facilitates :

mass production, which makes them cheaper;

rational use of up-to-date handling gear : conveyors, elevator-stackers;

optimum user of the wagon capacity;

d) general propaganda in favour of good packing (France).

QUESTION 14. — *Are you of the opinion that the results of these researches into packing will lead to a reduction of damages? If so, give some concrete and striking examples.*

In general, the replies were in the affirmative. Not only the frequency but also the amount of damage are falling off.

In Belgium, damage to officially approved cardboard cases has been below 0.05 per thousand since 1945.

In the same country, the total amount of compensation paid has fallen from 9 ‰ of the receipts in 1946 to 1.8 ‰ in 1950, i. e. 1/5ths.

In France, compensation for eggs and foodstuffs has fallen by more than 50 % since the standardization of packings.

The Swiss Railways have no knowledge of any serious damage to packings recognised as suitable by their « packing question centre ».

SUMMARY.

PART II.

Packings.

1. *The packings used; their advantages, their drawbacks; the ideal packing.*

The packings used by the trade are generally satisfactory; their quality however depends to a great extent on the economic position of the consigning country; national products are predominently used.

The need to make the best possible use of the capacity of wagons, containers, pallets and other handling gear brings out the advantages of parallelepipedic packings of standardized dimensions. Owing to the standardization of pallets, the U. I. C. also tend to standardize packings.

Certain special circumstances may result in the exterior form of packings being modified :

the need for ventilation;

mechanical handling other than by pallets;

damage if parcels are turned upside down.

2. *Methods used to improve the condition of packings.*

There are three very different schools of thought. The first, which may be called the negative school, do not intervene in any way as they consider that only the consignor can judge of the suitability or otherwise of the packing, so that the railway should remain absolutely neutral.

The second which we might call the « persuasive » school, think the consignor should be given good advice by putting at his disposal the resources of technical research laboratories. They likewise make use of convincing arguments such as « discriminatory tariffs, privileged treatment should damage occurs ».

The third, the « imperative » consider it necessary to issue regulations binding the consignor and the railway.

To satisfy the authorities or the trade, taking into account the facilities granted by road hauliers, to make possible international exchanges of traffic, and to instruct their employees, each railway has had to give way on principles and try to come to some compromise.

One of the special problems of packings, *their re-use by the original consignor*, has had a great deal of attention from the railways, over many years. Many railways consider it necessary to facilitate re-use, either for the sake of the national economy (saving materials) or to encourage the trade to use stronger and more expensive types of packings, or finally to retain or attract transport where there is a great deal of competition.

Amongst packings which can be re-used, mention must be made of those that can be folded up. They have the great advantage of having a high specific weight when empty. Many railways expect them to have a brilliant future.

Considered from the particular point of

view of cost, the transport of empties which cannot be folded up does not appear very advantageous. The reductions granted by many railways to returned empties can only be justified if they are considered as an integral part of the transport when loaded which they tend to encourage.

A new tendency has come to light. The more careful manufacture of light packings has made it possible to reduce their cost whilst assuring that they are strong enough for a single journey. This has meant the birth of the once-used packing. This type of packing is the one currently used in intercontinental and international traffic, and is becoming more and more important in internal traffic also. Several railways are trying to encourage the use of this type of packing by refusing any concessions to returned empties (in general, or to some of them only).

3. Methods of investigation to ascertain the criteria of a good packing.

Many railways have endeavoured to profit from accidents that have happened during transport, and to instruct the staff responsible for dealing with claims and the staff accepting consignments for transport.

Systematic research into the causes of damage is only in its infancy in most of the countries consulted.

However certain railways are endeavouring to analyse the transport conditions by recording the shocks, stresses, and vibrations suffered by goods during transport. The use of shock recorders appears to be limited up to the present to full loads; it would appear desirable to use them also in the case of small consignments by inserting such instruments into the packings, which would also make it possible to examine how they are handled during the chain of transport.

When transport conditions are known, these should be repeated under laboratory conditions, and machines invented which will re-create the same conditions on a reduced scale, so that the effects on sample packings can be studied. We might mention amongst others :

— a tipping-drum which in a short time gives repeated rough handling of goods, which can be multiplied as desired;

— a press making it possible to observe the deformation of packings in various positions under the weight of increasing loads.

These two tests deal essentially with the behaviour of the packing as a whole and serve as a check on its suitability.

Other more widely used equipment makes it possible to examine the strength of the materials used : resistance to rubbing, to perforation, to reformation, to humidity, etc. which is particularly important when a traditional packing, whose effectiveness is generally recognised, has to be replaced by some other material : for example, paper sacks, cardboard cartons.

To end, let us explain that certain laboratories have set as their objectives :

— collaboration with the trade, when new types of packings are invented, to find that which gives the greatest degree of safety together with the minimum price, weight, and size;

— the granting of official approval, the official stamp testifying to the quality of the packing;

— standardization of materials and dimensions.

As for the spirit which animates the laboratory staff, we might say that this is sometimes « passive » as investigations are carried out « on demand » for the exclusive benefit of the person in question, and sometimes « active », research work being carried out on all possible occasions, and the laboratory staff visiting the goods depots, examining damaged or defective packings, and on their own initiative interviewing consignors in order to advise them and suggest improvements, or taking action through the technical press or by means of posters.

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OFFICIAL INFORMATION

ISSUED BY THE

PERMANENT COMMISSION

OF THE

International Railway Congress Association.

Meeting of the Permanent Commission, held on the 1st March 1952.

The Permanent Commission of the International Railway Congress Association met on the 1st March 1952, in the Belgian National Railways Head-Quarters Offices, in Brussels.

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Mr. DELORY, *President*, opening the meeting, welcomed the many personalities present. Then, he asked the Assembly to approve the minutes of the last meeting held in London, on the 5th March, 1951.

***

Mr. GHILAIN, *Vice-President and General Secretary*, informed the Meeting of the changes which occurred in the Permanent Commission since the last session. He gave particulars of the steps taken to fill the seat's vacancies.

The Meeting elected the following as Members of the Permanent Commission:

Mr. GSCHWIND, Dr., President of the General Direction of the Swiss Federal Railways, to replace Mr. C. LUCCHINI, who has retired;

Mr. R. KUNZ, Director of the Swiss Federal Office of Transports, to replace Mr. F. STEINER, who has retired;

Mr. John BENSTEAD, Deputy Chairman, British Transport Commission, to replace Mr. MILES BEEVOR, who has resigned;

Mr. J.M. GARCIA-LOMAS, Director of the Red Nacional de los Ferrocarriles Españoles, to replace Mr. E. ALFONSO, deceased;

Mr. Rafaël BENJUMEA Y BURIN, Earl OF GUADALHORCE, President of the Administration Board of the R.E.N.F.E., to replace Mr. J.M. RIVERO DE AGUILAR, called to other functions and who has resigned;

Mr. DIAS TRIGO, Director of the Working and Rolling Stock Department of the Inland Transport Direction of the Ministry of Public Works and Communications, Portugal, to replace Mr. DA COSTA COUVREUR, nominated Honorary Member of the Permanent Commission;

Mr. CREM, Operating Manager of the Belgian National Railways, to replace Mr. VANDERBORGHT, who has retired;

H. E. HASSAN BEY FAHMY, Deputy General Manager of the Egyptian State Railways, to replace H. E. KHADR GABR BEY, who has retired.

— *The complete list of the Members of the Permanent Commission is given in the Appendix, page 490.*

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Mr. GHILAIN, *General Secretary*, gave information on the preliminary arrangements made by the Swedish Local Organizing Commission in connection with the Enlarged Meeting of the Permanent Commission, which will take place in Stockholm from the 9th to the 12th June next. He mentioned particulars about the programme of the Session and the travelling facilities granted on the Danish, Swedish, Norwegian and Finnish Railways. On behalf of the Assembly, he thanked Mr. UPMARK, General Manager of the Swedish State Railways, for the kind arrangements made for the journey of the participants to the Stockholm Meeting. Then, he informed the Meeting of the names of the personalities chosen as Presidents of Section to preside over the technical discussions, and of the names of the special reporters for Questions I, II and III (1). He gave particulars regarding the publication of the reports in the *Bulletin* of the Association.

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The PRESIDENT advised the Assembly of a communication from Lord HURCOMB, President of the British Transport Commission, confirming the invitation of the British Government to hold the Congress of 1954, in London.

This communication was greeted with cheers by the Permanent Commission.

LORD HURCOMB expressed to the Meeting his great pleasure of being able to confirm this invitation and assured the Permanent Commission of the desire of the British Railways to reserve a hearty welcome to the Congress.

The GENERAL SECRETARY then gave knowledge of the questions, resulting from the suggestions received from the Members of the Permanent Commission, the affiliated Railway Administrations and Organizations, to constitute the agenda of the 1954 Congress.

After various exchanges of views between the Members of the Permanent Commission, eleven questions were selected for this Session. The definite list of these questions together with the names of the reporters, will be published in the future.

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The Meeting heard the report of the Auditors, who checked the accounts for the XVth Session, covering the years 1948, 1949 and 1950. This report was approved.

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The account of receipts and expenditure for the financial year 1951, was approved by the Assembly as well as the budget for 1952. To meet the financial needs in particular in view of the London Congress, the Meeting adopted the variable subscription for the year 1952 agreed to at

(1) The list of questions giving the names of the Reporters appeared in our Bulletin for November 1951, p. 788.

the London Meeting of 1951, i.e. 0.25 Gold-franc per kilometre.

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Information was also given about the changes which occurred in the membership since the meeting of the 5th March 1951.

The International Railway Congress Association at present includes 35 Governments, 8 Organizations and 106 Railway Administrations with a total mileage of 450 000 kilometres (280 000 miles).

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The Meeting ended after the examination of various points regarding the activities of the Association since the last Session of the Permanent Commission.

The General Secretary, P. Ghilain. *The President*, F.H. Delory.

List of Members of the Permanent Commission

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(1st MARCH 1952)

President :

F. H. **Delory** (3), directeur général de la Société Nationale des Chemins de fer belges; 19, rue du Beau-Site, Bruxelles.

Vice-presidents :

Goursat (1), directeur de la Région du Nord de la Société Nationale des Chemins de fer français; 18, rue de Dunkerque, Paris (X[e]);

P. **Ghilain** (2), directeur du Service du Matériel et des Achats de la Société Nationale des Chemins de fer belges; 19, rue du Beau-Site, Bruxelles.

Members of the Executive Committee :

Dorges (3), inspecteur général des Ponts et Chaussées, secrétaire général aux Travaux publics, directeur général des Chemins de fer et des Transports au Ministère des Travaux publics et des Transports; 244, boulevard Saint-Germain, Paris;

Lord **Hurcomb** (1), Chairman of the British Transport Commission; 55, Broadway, London, S. W. 1;

Sir Gilmour **Jenkins** (2), Secretary to Minister of Transport (Great-Britain); Berkeley Square House, Berkeley Square, London, W. 1.

Ex-presidents of session, members ex-officio :

Ing. G. **di Raimondo,** directeur général des Chemins de fer de l'Etat italien; Rome;

S. E. Ibrahim Fahmy **Kerim** Pacha; Le Caire;

D[r] W. **Meile,** ancien président de la Direction générale des Chemins de fer fédéraux suisses; Brügglerweg, 11, Berne.

Members :

S. E. Abdel Rahman el Sayed **Ammar** Bey (3), sous-secrétaire d'Etat au Ministère des Communications d'Egypte; Le Caire;

Armand (3), directeur général de la Société Nationale des Chemins de fer français; 88, rue St-Lazare, Paris (IX[e]);

F. Ch. **Badhwar** (3), Chairman, Railway Board, Ministry of Railways, Government of India; New Delhi;

V. M. **Barrington-Ward** (2), member of the Railway Executive (British Railways); 222, Marylebone Road, London, N. W. 1.;

R. **Benjumea y Burin,** Comte **de Guadalhorce** (3), Président du Conseil d'Administration du Réseau National des Chemins de fer espagnols; Madrid;

J. **Benstead** (1), Deputy Chairman of the British Transport Commission; 55, Broadway, London, S.W. 1;

Besnard (2), chef de service adjoint au directeur général des Chemins de fer et des Transports, Ministère des Travaux publics et des Transports; 244, boulevard Saint-Germain, Paris;

David **Blee** (3), member of the Railway Executive (British Railways); 222, Marylebone Road, London, N. W. 1;

J. **Bouciqué** (3), directeur du Service de la Voie de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

Ch. **Boyaux** (2), directeur général adjoint de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IX[e]);

R. **Claudon** (3), inspecteur général des Ponts et Chaussées, vice-président du Conseil d'administration de la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IX[e]);

M. W. **Clement** (1), Chairman of the Board Pennsylvania Railroad Company; Broad Street Station Building, 1617, Pennsylvania Boulevard, Philadelphia. 4, Pa.;

D[r] R. **Cottier** (1), directeur de l'Office Central des Transports Internationaux par Chemins de fer; Berne;

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(1) Retires at the 16th session.
(2) Retires at the 17th session.
(3) Retires at the 18th session.

T. C. **Courtney** (3), Chairman of the Coras Iompair Eireann, Kingsbridge Station, Dublin;

M. **Crem** (1), directeur du Service de l'Exploitation de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

Csanadi (1), Directeur Général des Chemins de fer de l'Etat hongrois; Budapest;

Dr Ing. A. **Cuttica** (3), chef du Service du Matériel et de la Traction des Chemins de fer de l'Etat italien; Florence;

Dargeou (3), directeur du Service central du Mouvement de la Société Nationale des Chemins de fer français; 8, rue de Londres, Paris, (IXe);

J. **de Aguinaga** (2), Director General de Ferrocarriles, Tranvias y Trasportes por Carretera; Madrid;

F. H. **Delory** (already named);

F. Q. **den Hollander** (1), président des Chemins de fer néerlandais; S. A.; Utrecht;

Ing. V. **Desic** (2), professeur à la Faculté Technique de Belgrade, Conseiller permanent du Ministère des Chemins de fer de la République fédérative populaire yougoslave; Belgrade;

M. **Devos** (1), directeur général de la Société Nationale belge des Chemins de fer vicinaux; 14, rue de la Science, Bruxelles;

Dias Trigo (1), directeur des Services d'Exploitation et du Matériel de la Direction des Transports terrestres au Ministère des Travaux publics et des Communications du Portugal; Lisbonne;

Ing. G. **di Raimondo** (already named);

Dorges (already named).;

S. E. Mohamed **El Wakil** (1), Ministre des Communications d'Egypte; Le Caire;

J. **Elliot** (1), Chairman of the Railway Executive (British Railways); 222, Marylebone Road, London, N. W. 1;

S. E. **Hassan Bey Fahmy** (3), directeur général adjoint de l'Administration des Chemins de fer, Télégraphes et Téléphones de l'Etat égyptien; Le Caire;

W. T. **Farici** (3), president, Association of American Railroads; Transportation Building, Washington, 6. D. C.;

Dr Ing. F. **Fazio** (1), conseiller d'administration aux Chemins de fer de l'Etat italien; Rome;

J. M. **Garcia-Lomas** (2), directeur du Réseau National des Chemins de fer espagnols; Madrid;

P. **Ghilain** (already named);

Goursat (already named);

Dr. Gschwind (2), président de la Direction générale des Chemins de fer fédéraux suisses; Berne;

Ranald J. **Harvey** (3), consulting engineer to the Government of New Zealand (Railways); 34, Victoria Street, Westminster, London, S. W. 1;

Lord **Hurcomb** (already named);

Dr **Huyberechts** (2), directeur général adjoint de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

Sir Gilmour **Jenkins** (already named);

Ing. Ch. **Kalitzov** (2), chef de la Section du mouvement des Chemins de fer et des Ports de l'Etat bulgare; Sofia;

A. **Kriz** (3), ingénieur, conseiller supérieur de Section au Ministère des Communications de la République tchécoslovaque; Prague;

R. **Kunz** (2), directeur de l'Office fédéral des transports; Berne;

Dr N. **Laloni** (1), chef du Service Commercial et du Trafic des Chemins de fer de l'Etat italien; Rome;

Dr Ing. G. **Lasz** (3), conseiller d'administration aux Chemins de fer de l'Etat italien; Rome;

Lemaire (2), directeur à la Société Nationale des Chemins de fer français; 88, rue Saint-Lazare, Paris (IXe).

R. **Lévi** (2), directeur des Installations fixes de la Société Nationale des Chemins de fer français; 42, rue de Châteaudun, Paris;

G. **Lindenberg** (3), advisory engineer to the High Commissioner for the Union of South Africa; South Africa House, Trafalgar Square, London, W. C. 2;

Ing. R. **Luna** (2), directeur général des Chemins de fer de l'Etat argentin; Buenos-Aires;

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(1) Retires at the 16th session.
(2) Retires at the 17th session.
(3) Retires at the 18th session.

M. **Malderez** (2), secrétaire général du Ministère des Communications de Belgique; 17*a*, rue de la Loi, Bruxelles;

Ing. F. **Marin** (3), vice-directeur général des Chemins de fer de l'Etat italien; Rome;

Ing. P. P. **Martin** (1), directeur national de la Planification et de la Coordination du Ministère des Transports de la République d'Argentine; Buenos-Aires;

Dr W. **Meile** (already named);

P. **Nolet de Brauwere** (3), Secrétaire Général de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

J. H. **Nuelle** (3), president, Delaware & Hudson Railroad Corporation; 32, Nassau Street, New York City;

G. **Olivier** (1), directeur général adjoint de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

Dr Ing. V. **Perrone** (1), inspecteur général supérieur de la Motorisation Civile et des Transports concédés; Rome;

X. **Remy** (1), directeur des Chemins de fer Fribourgeois et président de l'Union d'Entreprises suisses de Transport; 3, avenue de Pérolles; Fribourg;

R. A. **Riddles** (2), member of the Railway Executive (British Railways); 222, Marylebone Road, London, N. W. 1;

Dr M. **Schantl** (3), Secrétaire général des Chemins de fer fédéraux autrichiens; 9, Elizabethstrasse, Vienne I;

H. E. **Stokke** (2), directeur général des Chemins de fer de l'Etat norvégien; Oslo;

E. D. **Terkelsen** (3), directeur général des Chemins de fer de l'Etat danois; 40, Sölvgade, Copenhague, K;

J. C. L. **Train** (2), member of the Railway Executive (British Railways); 222, Marylebone Road, London, N. W. 1;

Tuja (1), secrétaire général de l'Union internationale des Chemins de fer; 10, rue de Prony, Paris;

E. G. J. **Üpmark** (2), directeur général des Chemins de fer de l'Etat suédois; Stockholm;

H. **van Galen Last** (3), directeur général des Transports au Ministère des Transports et du Waterstaat; La Haye;

F. Perez **Villamil** (2), directeur adjoint du Réseau National des Chemins de fer espagnols; Madrid;

Wagner (1), ingénieur en chef au Ministère des Communications de Pologne; Varsovie;

S. E. le Dr Sayed Abdel **Wahed** Bey (3), directeur général à l'Administration des Chemins de fer, Télégraphes et Téléphones de l'Etat égyptien; Le Caire;

R. B. **White** (1), president, Baltimore & Ohio Railroad Company; Baltimore, Md;

Lt.-Col. G. R. S. **Wilson** (2), chief inspecting officer of Railways, Ministry of Transport; Berkeley Square House, Berkeley Square, London, W. 1;

N... (2), China.

N... (2) Rumania.

N... (2) Switzerland.

Honorary members : R. **da Costa Couvreur,** ancien président du Conseil supérieur des Travaux publics au Ministère des Travaux publics et des Communications du Portugal; Alameda das Linhas de Torres, 149, Lisbonne;

U. **Lamalle,** directeur général honoraire de la Société Nationale des Chemins de fer belges, professeur de cours de chemins de fer à l'Université de Louvain; 175, avenue Winston Churchill, Uccle-Bruxelles.

(1) Retires at the 16th session.
(2) Retires at the 17th session.
(3) Retires at the 18th session.

SECRETARY'S OFFICE : **19, rue du Beau Site, Brussels.**

General Secretary : **P. Ghilain.**